

ANTI - FRICTION LINESHAFT BEARINGS

BY

A. S. ALTER

A. KATZINGER

ARMOUR INSTITUTE OF TECHNOLOGY

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lineshaft bearings

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A STUDY OF
**ANTI-FRICTION LINESHAFT
BEARINGS**

A THESIS

PRESENTED BY

**ARTHUR KATZINGER
ARTHUR S. ALTER**

TO THE

PRESIDENT AND FACULTY

OF

ARMOUR INSTITUTE OF TECHNOLOGY

FOR THE DEGREE OF

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HAVING COMPLETED THE PRESCRIBED COURSE OF STUDY IN

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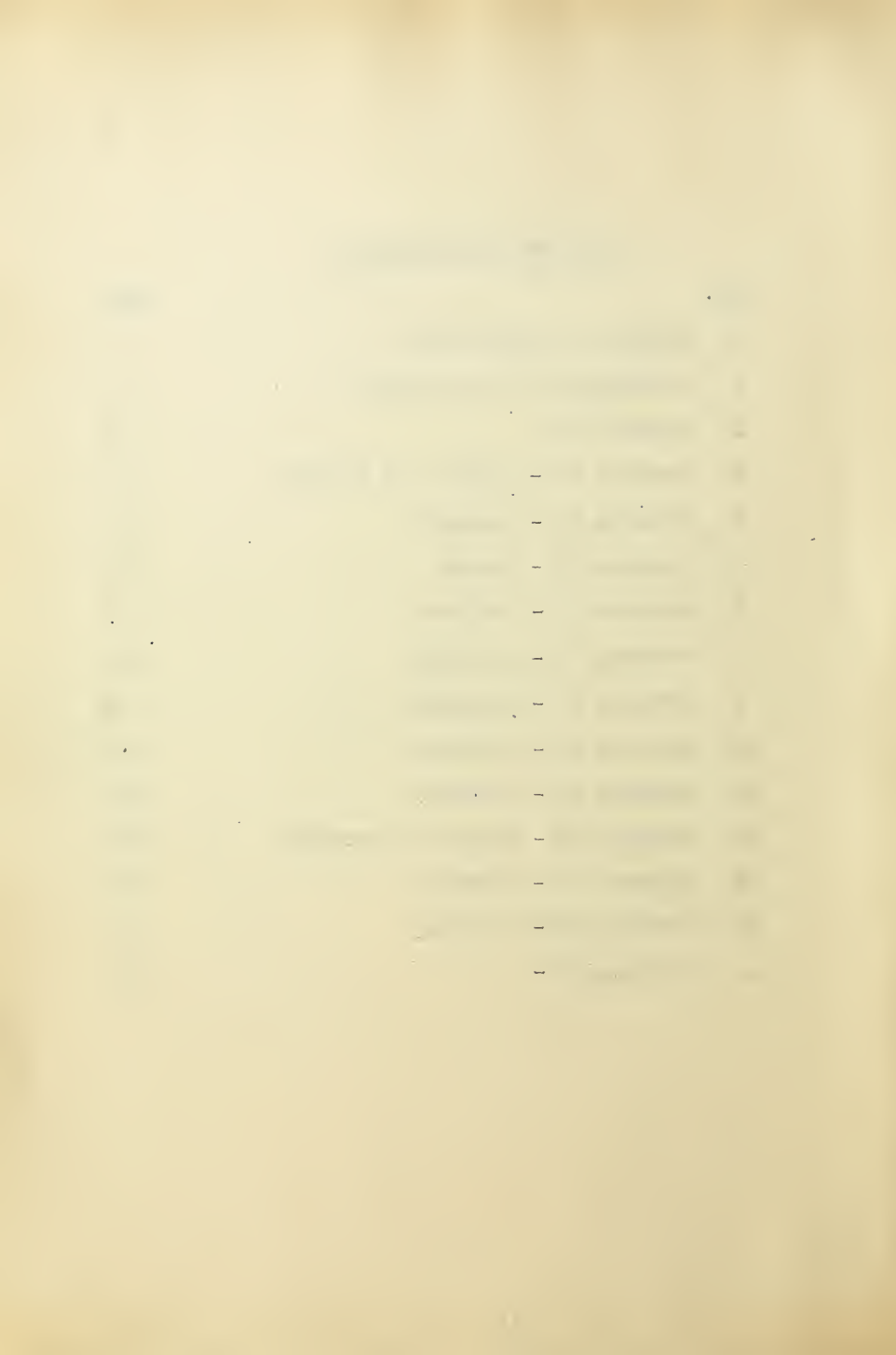
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INTRODUCTION

INTRODUCTION

The object of this test is the determination of the coefficient of friction and the horse power necessary to drive various types of line shafting bearings. Much research work has been done along these lines, but, no information is available which compares in a logical manner babbitt, roller and ball bearings.

In conducting these tests, the three types of bearings were operated at various loads and speeds varying from maximum to minimum. The power input was determined by means of a carefully calibrated reaction dynamometer and the coefficient of friction was calculated from the resulting data.

The bearings tested were: one ball, three roller and one babbitt. The method of procedure for one bearing was exactly the same for another. In each case the amount and kind of lubricant called for by the manufacturers of the bearings

was used. Before mounting a set of bearings on the shaft each one was thoroughly cleaned and the lubricant replaced.

ARRANGEMENT OF APPARATUS
AND
METHOD OF TESTING

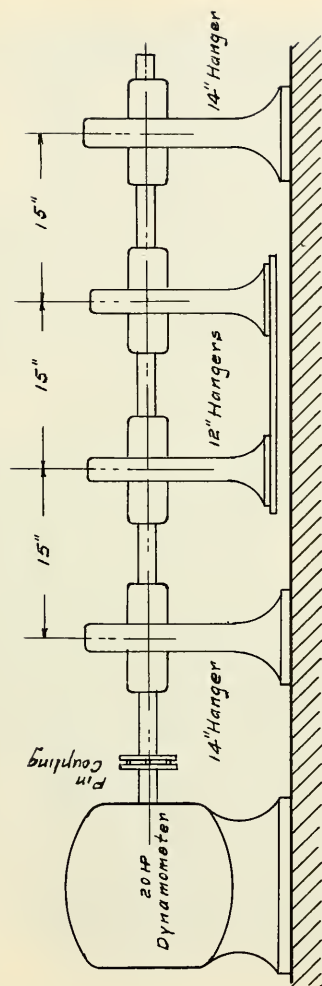




Fig. 2



ARRANGEMENT OF APPARATUS AND METHOD OF TESTING.

Two of the bearings were mounted in 14 inch hangers, and these hangers were bolted to a surfaced steel table and placed 45 inches from each other. The other two bearings were mounted in 12 inch hangers and spaced 15 inches center to center and midway between the first two hangers.(Fig.1)

A plate was bolted on the bottoms of the two middle hangers and served as a platform to receive the dead weight. The two central hangers were two inches shorter than the two outside hangers, thereby allowing the central unit to swing freely about the shaft.

The shaft was coupled to the 20 H.P. dynamometer. Two collars were placed on one of the center bearings and two on one of the end bearings to prevent end thrust travel.

All bearings were taken from the stock

intended for sale and were new. All sets were operated until the friction became constant. After these preliminary runs, the apparatus was allowed to stand over night so as to insure uniform temperature conditions for each set of tests.

The load was placed in carriers hung upon a stationary beam which rested on the plate supported by the two center hangers. The friction load was transmitted through the agency of the dynamometer arm to a sensitive scale.

The first load applied was 3000 pounds or 1500 pounds per bearing, and the speed of the shaft was the maximum which the bearing could stand. The speed was obtained by an electric speed counter and checked by a hand revolution counter. The load on the scale was read at the same time. The speed was then lowered a few hundred R.P.M. and the load on scale again read. This process was repeated until the shaft was going as slowly as the motor

would turn it. Then the load was reduced from 3000 to 2700 and the entire process repeated; about twelve readings being taken for each load from 1500 down to 300 in increments of 150 pounds. The load of 300 was the minimum since this represented the actual weight of the hangers, bearings, shaft and plate.

This completed the run for a set of bearings, but, in order to verify the results the shaft and bearings were allowed to cool off until the next morning and the test repeated.

GENERAL THEORY

GENERAL THEORY

The load on the two center bearings consisted of, the weights of the two center bearings, the two center hangers, the cast iron plate and the added dead weight. The total load on the two end bearings was the above weight plus the weight of the shaft and coupling. The average load per bearing was, therefore, one-half of the weight of the two center bearings, the cast iron plate, the shaft and coupling, and the added weights. This is the load recorded in the tables, and ranges from 1500 pounds maximum to 300 pounds minimum.

All readings were taken simultaneously. The dynamometer was tested for balance before each new set of runs, thus insuring accuracy.

The torque was obtained by multiplying the force on the scale by the lever arm of the dynamometer, in our case $31\frac{1}{2}$ inches. This torque was in inch pounds, and repre-

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sented the torque necessary to drive the four bearings and one-fourth of this was the torque necessary to drive one bearing.

The H. P. necessary to drive one bearing at any load and speed, was computed from the torque and speed by accepted methods:

$$\text{H.P.} = \frac{\text{Lbs.} \times \text{R.P.M.}}{2000}$$

The 2000 is the constant of this dynamometer.

The coefficient of friction was computed from the load and the torque. It is readily seen that the torque at the shaft is equal to the ratio of the lever arm of the dynamometer to the lever arm of the shaft, the radius, times the torque at the dynamometer arm, as follows:--

$$\text{No. Lbs. torque} \times \frac{31.5''}{\frac{1.7''}{32}} = \text{torque at shaft.}$$

The coefficient of friction is the torque at the shaft divided by the load.

$$\text{Coefficient of friction} = K. = \frac{\text{torque at shaft}}{\text{load}}$$

Let the force be F and the distance be d .
 The work done is $F \cdot d$.
 The force is constant, so the work is
 simply $F \cdot d$.
 The work done is $F \cdot d$.

$$W = F \cdot d$$

The work is the product of the

force and the distance.

The work done is $F \cdot d$.

Let the force be F and the distance be d .

It is $F \cdot d$ that we want to find.

The work done is $F \cdot d$.

Let the force be F and the distance be d .

The work done is $F \cdot d$.

The work done is $F \cdot d$.

$$W = F \cdot d$$

The work done is $F \cdot d$.

Let the force be F and the distance be d .

$$W = F \cdot d$$

The coefficient of friction was computed in two ways. In the first method, as outlined on page 12, designated in the tables as "A", the actual radius of the shaft was used. In the second method, the radius of the ball or roller line circumference was used.

It is a difficult matter to decide which is the proper way to figure the coefficient. It can be seen from the formula for the coefficient of friction that the ball and roller bearings assume a decided advantage over the babbitt bearing by the use of method "B", inasmuch as the friction radius is increased by taking it as the distance from center of ball or roller to the center of shaft, and an increase in the friction radius decreases the coefficient of friction.

In most of the testing done to date, the coefficient of friction was usually figured by method "B", but, it is the opinion of the writers that it is unfair to the babbitt bearings and for that reason, a preference

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has been given to method "A". In a ball or roller bearing, the friction really acts at the tracks on which the balls or rolls turn, but, for purposes of comparison with plain bearings, the friction is referred to the bearing bore, which is identical with the shaft diameter.

It is understood that a comparison of the coefficient of friction of bearings is necessary, but, at the same time, it should be understood that the coefficient of friction influences, not so much the amount of power to drive the shafting, as it influences the bearing itself. A high coefficient will shorten the life of the bearing, because a great quantity of rubbing and lashing will occur which will injure the bearing constituents. This will be used up energy changed to the form of heat, and it will ultimately cause an increase in the power necessary to drive. But, if an anti-friction bearing be properly designed, there is little danger of an excessive coefficient of friction and the usual

loss of power through heating.

For this reason, the truest comparison of bearings is to compare the horse power necessary to drive, and that the best bearing, is, the one which will run cold at any ordinary speed and load and require the least amount of power.

An important point in economic power transmission is lubrication. The manufacturers of babbitt bearings all recommend the use of machine oil, and in some instances, they have made tests to find out which oil was best suited to their bearing and how often and how much was required. But, when the anti-friction bearings came into use, the manufacturers maintained that ball and roller bearings should survive in the absence of lubrication, but, they now recommend the use of a lubricant, because, foreign matter in the raceways cannot be eliminated in any other way.

This does not necessarily mean that lubrication increases the efficiency of a

properly designed ball or roller bearing, for the reverse is true, as has been illustrated by experiments. They will give a lower coefficient of friction when running clean and dry than when lubricated by even a thin oil.

In perfectly lubricated journal bearings, there is no metallic contact between surfaces, but, in the ball and roller bearings, there is always metallic contact.

The coefficient of friction for sliding contact is much higher than for rolling contact. The coefficient of rest and slow motion is much greater for sliding friction than for rolling.

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. CLASSIFICATION OF
BEARINGS TESTED

CLASSIFICATION OF BEARINGS TESTED

For all convenience in this work, each type of bearing tested is to be referred to by initial, as follows:--

BEARING

"A".....DUPLEX TAPER ROLLER.

"B".....HELICAL ROLLER.

"C".....BABBITTED RING OILED.

"D".....DOUBLE ROW SELF ALIGNING
BALL BEARING.

"E".....CYLINDRICAL PLAIN ROLLER.

THE HISTORY OF THE UNITED STATES

THE HISTORY OF THE UNITED STATES
 FROM 1776 TO 1876
 BY J. W. FULTON

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BEARING "A"

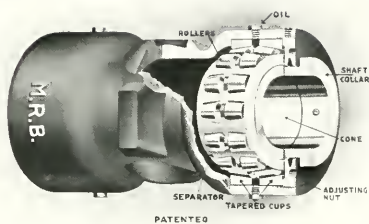


Fig. 3

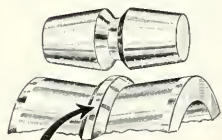


Fig. 4



Fig. 5

BEARING "A"

Bearing "A" (Figures 3,4,5) is a duplex roller bearing having as its chief feature, two sets of double tapered rollers. The housing of cast iron has a diameter sufficient to contain one set of rolls in each end.

A hardened steel cone fits on the shaft and revolves with it. The double tapered rolls run on this cone and are held central by means of a projection in the center of the cone which fits into the groove of the rolls. (Fig.4) The rolls are kept at a constant distance from each other by means of a bronze separator.

On the top of the rolls are two tapered cups arranged so that one is on the one taper of the roll and one on the other. These two tapered cups act as the upper raceway for the rolls.

The whole set fits inside one end of the housing, the end of which is threaded to accomodate a nut which when screwed in tightens

or loosens the tapered cups against the rolls. A set screw from the housing and onto the adjustment is tightened when the bearing is adjusted. Oil may be poured in through a hole in the top of the housing.

Bearing "A" being of the double taper type has in addition to the slippage due to misalignment and the slippage due to an area of contact instead of line contact, the slippage due to the double taper. This results from the fact that one laminae of the roll is revolving at a slightly greater or less speed than the next one due to its greater or less diameter, thus causing a slippage. But, the loss of power or increase in coefficient due to this, is negligible in comparison to the loss due to misalignment and irregularity of surface. For that reason, the firm manufacturing that bearing claims that after the bearing has been run in for two or three months, it runs at a greater efficiency due to the polish of the

surfaces and grinding out of the rough spots on the separator.

A good feature of Bearing "A", is, that it showed very little tendency toward the introduction of end thrust. The fact, that the collars which go with this bearing fit so that they revolve on the shaft and at the same speed as the bearing sleeve, eliminates any friction due to end thrust which is a most desirable feature.

The bearing did not heat up to any extent, except on such loads and speeds which very seldom are used for line shafting work. As can be seen by the data sheets and curves, this bearing was run at higher speed than any of the others. At the high speeds and loads, the grease ran hot, but, as a whole, the bearing ran remarkably cool.

Another good feature about this bearing is, its adaptability to adjustment.

TABLES 1 - 16
of
BEARING "A"

B E A R I N G A

Table No. 1 Date July 2nd, 1915.

Bearing Load, LBS. 1500 Time, beginning of run 8:20 A.M.

Room Temp.° Fahr. 75 Time, end of run 8:44 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.55	1619	17.42		0.445	0.0095	0.0062
0.54	1513	17.00		0.408	0.0093	0.0061
0.535	1368	16.88		0.366	0.0092	0.0060
0.52	1148	16.40		0.298	0.0090	0.0058
0.505	876	15.91		0.219	0.0087	0.0056
0.52	806	16.40		0.208	0.0090	0.0058
0.525	679	16.57		0.178	0.0091	0.0059
0.535	611	16.88		0.163	0.0092	0.0060
0.55	501	17.42		0.138	0.0095	0.0062
0.57	372	17.98		0.106	0.0098	0.0064
0.62	212	19.56		0.066	0.0107	0.0069

Remarks:—

Year	Month	Day	Hour	Minute	Second
1900	Jan	1	12	00	00
1900	Jan	2	12	00	00
1900	Jan	3	12	00	00
1900	Jan	4	12	00	00
1900	Jan	5	12	00	00
1900	Jan	6	12	00	00
1900	Jan	7	12	00	00
1900	Jan	8	12	00	00
1900	Jan	9	12	00	00
1900	Jan	10	12	00	00
1900	Jan	11	12	00	00
1900	Jan	12	12	00	00
1900	Jan	13	12	00	00
1900	Jan	14	12	00	00
1900	Jan	15	12	00	00
1900	Jan	16	12	00	00
1900	Jan	17	12	00	00
1900	Jan	18	12	00	00
1900	Jan	19	12	00	00
1900	Jan	20	12	00	00
1900	Jan	21	12	00	00
1900	Jan	22	12	00	00
1900	Jan	23	12	00	00
1900	Jan	24	12	00	00
1900	Jan	25	12	00	00
1900	Jan	26	12	00	00
1900	Jan	27	12	00	00
1900	Jan	28	12	00	00
1900	Jan	29	12	00	00
1900	Jan	30	12	00	00
1900	Jan	31	12	00	00

B E A R I N G A

Table No. 2 Date July 2nd, 1915.

Bearing Load, LBS. 1350 Time, beginning of run 8:44 A.M.

Room Temp.° Fahr. 75 Time, end of run 9:06 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.50	1743	15.75		0.436	0.0096	0.0062
0.485	1622	15.27		0.393	0.0093	0.0061
0.48	1446	15.11		0.347	0.0092	0.0060
0.47	1273	14.80		0.299	0.0090	0.0058
0.46	971	14.48		0.223	0.0088	0.0057
0.48	836	15.11		0.201	0.0092	0.0060
0.485	725	15.27		0.176	0.0093	0.0061
0.49	646	15.41		0.158	0.0094	0.0061
0.51	481	16.07		0.122	0.0098	0.0061
0.55	305	17.31		0.084	0.0105	0.0068
0.58	189	18.89		0.057	0.0115	0.0075

Remarks:—

• • • • •

B E A R I N G A

Table No. 3 Date July 2, 1915.

Bearing Load, LBS. 1200 Time, beginning of run 9:06 A.M.

Room Temp.° Fahr. 75 Time, end of run 9:23 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.46	1863	14.50		0.429	0.0099	0.0064
0.445	1714	14.02		0.382	0.0096	0.0062
0.425	1502	13.36		0.319	0.0091	0.0059
0.405	1216	12.75		0.246	0.0087	0.0056
0.40	1002	12.60		0.200	0.0086	0.0056
0.405	878	12.75		0.178	0.0087	0.0056
0.405	781	12.75		0.158	0.0087	0.0056
0.405	709	12.75		0.144	0.0087	0.0056
0.415	566	13.06		0.118	0.0089	0.0058
0.48	286	15.12		0.069	0.0103	0.0067
0.52	181	16.38		0.047	0.0112	0.0073

Remarks:—

Table 1

Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction.

The following table shows the results of the experiments on the effect of the concentration of the solution on the rate of the reaction.

The following table shows the results of the experiments on the effect of the concentration of the solution on the rate of the reaction.

Concentration of the solution (M)	Rate of the reaction (mol/l.s)	Concentration of the solution (M)	Rate of the reaction (mol/l.s)	Concentration of the solution (M)	Rate of the reaction (mol/l.s)
0.1	0.01	0.2	0.02	0.3	0.03
0.2	0.02	0.3	0.03	0.4	0.04
0.3	0.03	0.4	0.04	0.5	0.05
0.4	0.04	0.5	0.05	0.6	0.06
0.5	0.05	0.6	0.06	0.7	0.07
0.6	0.06	0.7	0.07	0.8	0.08
0.7	0.07	0.8	0.08	0.9	0.09
0.8	0.08	0.9	0.09	1.0	0.10
0.9	0.09	1.0	0.10	1.1	0.11
1.0	0.10	1.1	0.11	1.2	0.12
1.1	0.11	1.2	0.12	1.3	0.13
1.2	0.12	1.3	0.13	1.4	0.14
1.3	0.13	1.4	0.14	1.5	0.15
1.4	0.14	1.5	0.15	1.6	0.16
1.5	0.15	1.6	0.16	1.7	0.17
1.6	0.16	1.7	0.17	1.8	0.18
1.7	0.17	1.8	0.18	1.9	0.19
1.8	0.18	1.9	0.19	2.0	0.20
1.9	0.19	2.0	0.20	2.1	0.21
2.0	0.20	2.1	0.21	2.2	0.22
2.1	0.21	2.2	0.22	2.3	0.23
2.2	0.22	2.3	0.23	2.4	0.24
2.3	0.23	2.4	0.24	2.5	0.25
2.4	0.24	2.5	0.25	2.6	0.26
2.5	0.25	2.6	0.26	2.7	0.27
2.6	0.26	2.7	0.27	2.8	0.28
2.7	0.27	2.8	0.28	2.9	0.29
2.8	0.28	2.9	0.29	3.0	0.30
2.9	0.29	3.0	0.30	3.1	0.31
3.0	0.30	3.1	0.31	3.2	0.32
3.1	0.31	3.2	0.32	3.3	0.33
3.2	0.32	3.3	0.33	3.4	0.34
3.3	0.33	3.4	0.34	3.5	0.35
3.4	0.34	3.5	0.35	3.6	0.36
3.5	0.35	3.6	0.36	3.7	0.37
3.6	0.36	3.7	0.37	3.8	0.38
3.7	0.37	3.8	0.38	3.9	0.39
3.8	0.38	3.9	0.39	4.0	0.40
3.9	0.39	4.0	0.40	4.1	0.41
4.0	0.40	4.1	0.41	4.2	0.42
4.1	0.41	4.2	0.42	4.3	0.43
4.2	0.42	4.3	0.43	4.4	0.44
4.3	0.43	4.4	0.44	4.5	0.45
4.4	0.44	4.5	0.45	4.6	0.46
4.5	0.45	4.6	0.46	4.7	0.47
4.6	0.46	4.7	0.47	4.8	0.48
4.7	0.47	4.8	0.48	4.9	0.49
4.8	0.48	4.9	0.49	5.0	0.50
4.9	0.49	5.0	0.50	5.1	0.51
5.0	0.50	5.1	0.51	5.2	0.52
5.1	0.51	5.2	0.52	5.3	0.53
5.2	0.52	5.3	0.53	5.4	0.54
5.3	0.53	5.4	0.54	5.5	0.55
5.4	0.54	5.5	0.55	5.6	0.56
5.5	0.55	5.6	0.56	5.7	0.57
5.6	0.56	5.7	0.57	5.8	0.58
5.7	0.57	5.8	0.58	5.9	0.59
5.8	0.58	5.9	0.59	6.0	0.60
5.9	0.59	6.0	0.60	6.1	0.61
6.0	0.60	6.1	0.61	6.2	0.62
6.1	0.61	6.2	0.62	6.3	0.63
6.2	0.62	6.3	0.63	6.4	0.64
6.3	0.63	6.4	0.64	6.5	0.65
6.4	0.64	6.5	0.65	6.6	0.66
6.5	0.65	6.6	0.66	6.7	0.67
6.6	0.66	6.7	0.67	6.8	0.68
6.7	0.67	6.8	0.68	6.9	0.69
6.8	0.68	6.9	0.69	7.0	0.70
6.9	0.69	7.0	0.70	7.1	0.71
7.0	0.70	7.1	0.71	7.2	0.72
7.1	0.71	7.2	0.72	7.3	0.73
7.2	0.72	7.3	0.73	7.4	0.74
7.3	0.73	7.4	0.74	7.5	0.75
7.4	0.74	7.5	0.75	7.6	0.76
7.5	0.75	7.6	0.76	7.7	0.77
7.6	0.76	7.7	0.77	7.8	0.78
7.7	0.77	7.8	0.78	7.9	0.79
7.8	0.78	7.9	0.79	8.0	0.80
7.9	0.79	8.0	0.80	8.1	0.81
8.0	0.80	8.1	0.81	8.2	0.82
8.1	0.81	8.2	0.82	8.3	0.83
8.2	0.82	8.3	0.83	8.4	0.84
8.3	0.83	8.4	0.84	8.5	0.85
8.4	0.84	8.5	0.85	8.6	0.86
8.5	0.85	8.6	0.86	8.7	0.87
8.6	0.86	8.7	0.87	8.8	0.88
8.7	0.87	8.8	0.88	8.9	0.89
8.8	0.88	8.9	0.89	9.0	0.90
8.9	0.89	9.0	0.90	9.1	0.91
9.0	0.90	9.1	0.91	9.2	0.92
9.1	0.91	9.2	0.92	9.3	0.93
9.2	0.92	9.3	0.93	9.4	0.94
9.3	0.93	9.4	0.94	9.5	0.95
9.4	0.94	9.5	0.95	9.6	0.96
9.5	0.95	9.6	0.96	9.7	0.97
9.6	0.96	9.7	0.97	9.8	0.98
9.7	0.97	9.8	0.98	9.9	0.99
9.8	0.98	9.9	0.99	10.0	1.00
9.9	0.99	10.0	1.00	10.1	1.01
10.0	1.00	10.1	1.01	10.2	1.02
10.1	1.01	10.2	1.02	10.3	1.03
10.2	1.02	10.3	1.03	10.4	1.04
10.3	1.03	10.4	1.04	10.5	1.05
10.4	1.04	10.5	1.05	10.6	1.06
10.5	1.05	10.6	1.06	10.7	1.07
10.6	1.06	10.7	1.07	10.8	1.08
10.7	1.07	10.8	1.08	10.9	1.09
10.8	1.08	10.9	1.09	11.0	1.10
10.9	1.09	11.0	1.10	11.1	1.11
11.0	1.10	11.1	1.11	11.2	1.12
11.1	1.11	11.2	1.12	11.3	1.13
11.2	1.12	11.3	1.13	11.4	1.14
11.3	1.13	11.4	1.14	11.5	1.15
11.4	1.14	11.5	1.15	11.6	1.16
11.5	1.15	11.6	1.16	11.7	1.17
11.6	1.16	11.7	1.17	11.8	1.18
11.7	1.17	11.8	1.18	11.9	1.19
11.8	1.18	11.9	1.19	12.0	1.20
11.9	1.19	12.0	1.20	12.1	1.21
12.0	1.20	12.1	1.21	12.2	1.22
12.1	1.21	12.2	1.22	12.3	1.23
12.2	1.22	12.3	1.23	12.4	1.24
12.3	1.23	12.4	1.24	12.5	1.25
12.4	1.24	12.5	1.25	12.6	1.26
12.5	1.25	12.6	1.26	12.7	1.27
12.6	1.26	12.7	1.27	12.8	1.28
12.7	1.27	12.8	1.28	12.9	1.29
12.8	1.28	12.9	1.29	13.0	1.30
12.9	1.29	13.0	1.30	13.1	1.31
13.0	1.30	13.1	1.31	13.2	1.32
13.1	1.31	13.2	1.32	13.3	1.33
13.2	1.32	13.3	1.33	13.4	1.34
13.3	1.33	13.4	1.34	13.5	1.35
13.4	1.34	13.5	1.35	13.6	1.36
13.5	1.35	13.6	1.36	13.7	1.37
13.6	1.36	13.7	1.37	13.8	1.38
13.7	1.37	13.8	1.38	13.9	1.39
13.8	1.38	13.9	1.39	14.0	1.40
13.9	1.39	14.0	1.40	14.1	1.41
14.0	1.40	14.1	1.41	14.2	1.42
14.1	1.41	14.2	1.42	14.3	1.43
14.2	1.42	14.3	1.43	14.4	1.44
14.3	1.43	14.4	1.44	14.5	1.45
14.4	1.44	14.5	1.45	14.6	1.46
14.5	1.45	14.6	1.46	14.7	1.47
14.6	1.46	14.7	1.47	14.8	1.48
14.7	1.47	14.8	1.48	14.9	1.49
14.8	1.48	14.9	1.49	15.0	1.50
14.9	1.49	15.0	1.50	15.1	1.51
15.0	1.50	15.1	1.51	15.2	1.52
15.1	1.51	15.2	1.52	15.3	1.53
15.2	1.52	15.3	1.53	15.4	1.54
15.3	1.53	15.4	1.54	15.5	1.55
15.4	1.54	15.5	1.55	15.6	1.56
15.5	1.55	15.6	1.56	15.7	1.57
15.6	1.56	15.7	1.57	15.8	1.58
15.7	1.57	15.8	1.58	15.9	1.59
15.8	1.58	15.9	1.59	16.0	1.60
15.9	1.59	16.0	1.60	16.1	1.61
16.0	1.60	16.1	1.61	16.2	1.62
16.1	1.61	16.2	1.62	16.3	1.63
16.2	1.62	16.3	1.63	16.4	1.64
16.3	1.63	16.4	1.64	16.5	1.65
16.4	1.64	16.5	1.65	16.6	1.66
16.5	1.65	16.6	1.66	16.7	1.67
16.6	1.66	16.7	1.67	16.8	1.68
16.7	1.67	16.8	1.68	16.9	1.69
16.8	1.68	16.9	1.69	17.0	1.70
16.9	1.69	17.0	1.70	17.1	1.71
17.0	1.70	17.1	1.71	17.2	1.72
17.1	1.71	17.2	1.72	17.3	1.73
17.2	1.72	17.3	1.73	17.4	1.74
17.3	1.73	17.4	1.74	17.5	1.75
17.4	1.74	17.5	1.75	17.6	1.76
17.5	1.75	17.6	1.76	17.7	1.77
17.6	1.76	17.7	1.77	17.8	1.78
17.7	1.77	17.8	1.78	17.9	1.79
17.8	1.78	17.9	1.79	18.0	1.80
17.9	1.79	18.0	1.80	18.1	1.81
18.0	1.80	18.1	1.81	18.2	1.82
18.1	1.81	18.2	1.82	18.3	1.83
18.2	1.82	18.3	1.83	18.4	1.84
18.3	1.83	18.4	1.84	18.5	1.85
18.4	1.84	18.5	1.85	18.6	1.86
18.5	1.85	18.6	1.86	18.7	1.87
18.6	1.86	18.7	1.87	18.8	1.88
18.7	1.87	18.8	1.88	18.9	1.89
18.8	1.88	18.9	1.89	19.0	1.90
18.9	1.89	19.0	1.90	19.1	1.91
19.0	1.90	19.1	1.91	19.2	1.92
19.1	1.91	19.2	1.92	19.3	1.93
19.2	1.92	19.3	1.93	19.4	1.94
19.3	1.93	19.4	1.94	19.5	1.95
19.4	1.94	19.5	1.95	19.6	1.96
19.5	1.95	19.6	1.96	19.7	1.97
19.6	1.96	19.7	1.97	19.8	1.98
19.7	1.97	19.8	1.98	19.9	1.99
19.8	1.98	19.9	1.99	20.0	2.00
19.9	1.99	20.0	2.00	20.1	2.01
20.0	2.00	20.1	2.01	20.2	2.02
20.1	2.01	20.2	2.02	20.3	2.03
20.2	2.02	20.3	2.03	20.4	2.04
20.3	2.03	20.4	2.04	20.5	2.05
20.4	2.04	20.5	2.05	20.6	2.06
20.5	2.05	20.6	2.06	20.7	2.07
20.6	2.06	20.7	2.07		

B E A R I N G A

Table No. 4 Date July 2nd, 1915.

Bearing Load, LBS. 1050 Time, beginning of run 9:23 A.M.

Room Temp.° Fahr. 75 Time, end of run 9:45 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.47	1956	14.78		0.460	0.0116	0.0075
0.43	1836	13.52		0.395	0.0106	0.0069
0.405	1715	12.75		0.347	0.0100	0.0065
0.39	1530	12.28		0.298	0.0096	0.0062
0.385	1241	12.10		0.239	0.0095	0.0062
0.325	919	11.80		0.172	0.0092	0.0060
0.365	810	11.48		0.148	0.0090	0.0058
0.365	688	11.48		0.126	0.0090	0.0058
0.375	510	11.80		0.096	0.0092	0.0060
0.425	269	13.38		0.057	0.0105	0.0068
0.475	170	14.92		0.046	0.0117	0.0076

Remarks:—

TABLE I

Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction.

Concentration of the solution	Rate of the reaction	Concentration of the solution	Rate of the reaction	Concentration of the solution	Rate of the reaction
0.1 M	0.01	0.2 M	0.02	0.3 M	0.03
0.2 M	0.02	0.3 M	0.03	0.4 M	0.04
0.3 M	0.03	0.4 M	0.04	0.5 M	0.05
0.4 M	0.04	0.5 M	0.05	0.6 M	0.06
0.5 M	0.05	0.6 M	0.06	0.7 M	0.07
0.6 M	0.06	0.7 M	0.07	0.8 M	0.08
0.7 M	0.07	0.8 M	0.08	0.9 M	0.09
0.8 M	0.08	0.9 M	0.09	1.0 M	0.10
0.9 M	0.09	1.0 M	0.10		
1.0 M	0.10				

B E A R I N G A

Table No. 5 Date July 2nd, 1915.

Bearing Load, LBS. 900 Time, beginning of run 9:45 A.M.

Room Temp.° Fahr. 75 Time, end of run 10:10 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.435	2065	13.70		0.453	0.0125	0.0081
0.39	1826	12.28		0.356	0.0112	0.0073
0.34	1687	10.70		0.287	0.0098	0.0064
0.33	1469	10.40		0.242	0.0095	0.0062
0.325	1279	10.23		0.208	0.0094	0.0061
0.32	948	10.08		0.152	0.0092	0.0060
0.32	841	10.08		0.135	0.0092	0.0060
0.315	715	9.93		0.113	0.0091	0.0059
0.32	490	10.08		0.079	0.0092	0.0060
0.37	242	10.64		0.045	0.0097	0.0063
0.40	166	12.60		0.033	0.0115	0.0075

Remarks:—

Table 1

Year		1980		1981	
Jan.	1980	100	100	100	100
Feb.	1980	100	100	100	100
Mar.	1980	100	100	100	100
Apr.	1980	100	100	100	100
May	1980	100	100	100	100
June	1980	100	100	100	100
July	1980	100	100	100	100
Aug.	1980	100	100	100	100
Sept.	1980	100	100	100	100
Oct.	1980	100	100	100	100
Nov.	1980	100	100	100	100
Dec.	1980	100	100	100	100
Jan.	1981	100	100	100	100
Feb.	1981	100	100	100	100
Mar.	1981	100	100	100	100
Apr.	1981	100	100	100	100
May	1981	100	100	100	100
June	1981	100	100	100	100
July	1981	100	100	100	100
Aug.	1981	100	100	100	100
Sept.	1981	100	100	100	100
Oct.	1981	100	100	100	100
Nov.	1981	100	100	100	100
Dec.	1981	100	100	100	100

B E A R I N G A

Table No. 6 Date July 2nd, 1915.

Bearing Load, LBS. 750 Time, beginning of run 10:10 A.M.

Room Temp.° Fahr. 75 Time, end of run 10:30 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.35	2205	11.02	0.386	0.0121	0.0079
0.325	2072	10.23	0.336	0.0112	0.0073
0.30	1834	9.46	0.275	0.0104	0.0067
0.28	1481	8.82	0.208	0.0097	0.0063
0.28	1308	8.82	0.183	0.0097	0.0063
0.27	1096	8.51	0.148	0.0093	0.0060
0.27	914	8.51	0.123	0.0093	0.0060
0.27	827	8.51	0.112	0.0093	0.0060
0.27	760	8.51	0.103	0.0093	0.0060
0.27	560	8.51	0.076	0.0093	0.0060
0.28	334	8.82	0.047	0.0097	0.0063
0.33	202	10.40	0.033	0.0114	0.0074

Remarks:—

B E A R I N G A

Table No. 7 Date July 2nd, 1915.

Bearing Load, LBS. 600 Time, beginning of run 10:30 A.M.

Room Temp.° Fahr. 75 Time, end of run 10:45 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.33	2316	10.40		0.382	0.0142	0.0092
0.31	1944	9.78		0.302	0.0134	0.0087
0.28	1626	8.82		0.228	0.0121	0.0078
0.26	1329	8.19		0.173	0.0112	0.0073
0.25	1077	7.88		0.135	0.0108	0.0070
0.23	972	7.25		0.112	0.0099	0.0064
0.21	856	6.61		0.090	0.0091	0.0059
0.20	653	6.30		0.065	0.0086	0.0056
0.255	221	8.04		0.028	0.0110	0.0071
0.275	148	8.67		0.020	0.0119	0.0077

Remarks:—

TABLE 1

Summary of results

for the various experiments conducted during the year 1964

and the results of the various experiments conducted during the year 1965

and the results of the various experiments conducted during the year 1966

Experiment	Year	Results	Conclusions	Remarks	References
1	1964	...	...	...	...
2	1964	...	...	...	...
3	1964	...	...	...	...
4	1964	...	...	...	...
5	1964	...	...	...	...
6	1964	...	...	...	...
7	1964	...	...	...	...
8	1964	...	...	...	...
9	1964	...	...	...	...
10	1964	...	...	...	...
11	1964	...	...	...	...
12	1964	...	...	...	...
13	1964	...	...	...	...
14	1964	...	...	...	...
15	1964	...	...	...	...
16	1964	...	...	...	...
17	1964	...	...	...	...
18	1964	...	...	...	...
19	1964	...	...	...	...
20	1964	...	...	...	...
21	1964	...	...	...	...
22	1964	...	...	...	...
23	1964	...	...	...	...
24	1964	...	...	...	...
25	1964	...	...	...	...
26	1964	...	...	...	...
27	1964	...	...	...	...
28	1964	...	...	...	...
29	1964	...	...	...	...
30	1964	...	...	...	...
31	1964	...	...	...	...
32	1964	...	...	...	...
33	1964	...	...	...	...
34	1964	...	...	...	...
35	1964	...	...	...	...
36	1964	...	...	...	...
37	1964	...	...	...	...
38	1964	...	...	...	...
39	1964	...	...	...	...
40	1964	...	...	...	...
41	1964	...	...	...	...
42	1964
43	1964
44	1964
45	1964
46	1964
47	1964
48	1964
49	1964
50	1964
51	1964
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58	1964
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61	1964
62	1964
63	1964
64	1964
65	1964
66	1964
67	1964
68	1964
69	1964
70	1964
71	1964
72	1964	...	...	...	...
73	1964	...	...	...	...
74	1964	...	...	...	...
75	1964	...	...	...	...
76	1964	...	...	...	...
77	1964	...	...	...	...
78	1964	...	...	...	...
79	1964	...	...	...	...
80	1964	...	...	...	...
81	1964	...	...	...	...
82	1964	...	...	...	...
83	1964	...	...	...	...
84	1964	...	...	...	...
85	1964	...	...	...	...
86	1964	...	...	...	...
87	1964	...	...	...	...
88	1964	...	...	...	...
89	1964	...	...	...	...
90	1964	...	...	...	...
91	1964	...	...	...	...
92	1964	...	...	...	...
93	1964	...	...	...	...
94	1964	...	...	...	...
95	1964	...	...	...	...
96	1964	...	...	...	...
97	1964	...	...	...	...
98	1964	...	...	...	...
99	1964	...	...	...	...
100	1964	...	...	...	...

B E A R I N G A

Table No. 8 Date July 2nd, 1915.

Bearing Load, LBS. 450 Time, beginning of run 10:45 A.M.

Room Temp.° Fahr. 75 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.29	2349	9.14	0.342	0.0167	0.0108	
0.25	1986	7.88	0.248	0.0144	0.0093	
0.23	1736	7.25	0.200	0.0132	0.0086	
0.215	1439	6.78	0.155	0.0124	0.0080	
0.20	1112	6.30	0.111	0.0115	0.0075	
0.19	970	5.99	0.092	0.0109	0.0071	
0.19	800	5.99	0.076	0.0109	0.0071	
0.185	603	5.83	0.056	0.0106	0.0069	
0.195	384	6.15	0.037	0.0112	0.0073	
	206	10.08	0.033	0.0184	0.0119	

Remarks:—

Table 1

Summary of data

Table 1 shows the summary of data for the first 1000 cases. The data are presented in the following table:

Case No.	Age	Sex	Occupation	Duration of Illness	Outcome
1	25	M	Teacher	10 days	Recovered
2	30	F	Homemaker	15 days	Recovered
3	28	M	Engineer	12 days	Recovered
4	35	F	Homemaker	18 days	Recovered
5	22	M	Student	8 days	Recovered
6	32	F	Homemaker	14 days	Recovered
7	27	M	Teacher	11 days	Recovered
8	38	F	Homemaker	16 days	Recovered
9	24	M	Student	9 days	Recovered
10	31	F	Homemaker	13 days	Recovered
11	29	M	Engineer	10 days	Recovered
12	33	F	Homemaker	17 days	Recovered
13	26	M	Teacher	11 days	Recovered
14	36	F	Homemaker	15 days	Recovered
15	23	M	Student	7 days	Recovered
16	34	F	Homemaker	14 days	Recovered
17	28	M	Engineer	12 days	Recovered
18	37	F	Homemaker	16 days	Recovered
19	25	M	Teacher	10 days	Recovered
20	30	F	Homemaker	15 days	Recovered

B E A R I N G A

Table No. 9 Date July 2nd, 1915.

Bearing Load, LBS. 300 Time, beginning of run _____

Room Temp.° Fahr. 75 Time, end of run 11:15 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.22	2577	6.93		0.283	0.0189	0.0123
0.185	2174	5.83		0.201	0.0159	0.0103
0.165	1743	5.20		0.144	0.0142	0.0092
0.135	1388	4.25		0.094	0.0116	0.0075
0.105	988	3.31		0.052	0.0091	0.0059
0.09	886	2.83		0.040	0.0078	0.0051
0.085	818	2.68		0.035	0.0073	0.0047
0.08	591	2.52		0.024	0.0069	0.0045
0.105	235	3.31		0.012	0.0091	0.0059
0.13	139	4.09		0.009	0.0112	0.0073

Remarks:—

1. The first part of the report is a general introduction to the subject of the study. It discusses the importance of the problem and the objectives of the research.

2. The second part of the report is a detailed description of the methods used in the study. It includes a discussion of the experimental design, the data collection procedures, and the statistical analysis techniques.

3. The third part of the report is a presentation of the results of the study. It includes a discussion of the findings, a comparison of the results with previous research, and a conclusion about the significance of the study.

Year	1950	1951	1952	1953	1954	1955
1950	100	100	100	100	100	100
1951	100	100	100	100	100	100
1952	100	100	100	100	100	100
1953	100	100	100	100	100	100
1954	100	100	100	100	100	100
1955	100	100	100	100	100	100
1956	100	100	100	100	100	100
1957	100	100	100	100	100	100
1958	100	100	100	100	100	100
1959	100	100	100	100	100	100
1960	100	100	100	100	100	100
1961	100	100	100	100	100	100
1962	100	100	100	100	100	100
1963	100	100	100	100	100	100
1964	100	100	100	100	100	100
1965	100	100	100	100	100	100
1966	100	100	100	100	100	100
1967	100	100	100	100	100	100
1968	100	100	100	100	100	100
1969	100	100	100	100	100	100
1970	100	100	100	100	100	100
1971	100	100	100	100	100	100
1972	100	100	100	100	100	100
1973	100	100	100	100	100	100
1974	100	100	100	100	100	100
1975	100	100	100	100	100	100
1976	100	100	100	100	100	100
1977	100	100	100	100	100	100
1978	100	100	100	100	100	100
1979	100	100	100	100	100	100
1980	100	100	100	100	100	100
1981	100	100	100	100	100	100
1982	100	100	100	100	100	100
1983	100	100	100	100	100	100
1984	100	100	100	100	100	100
1985	100	100	100	100	100	100
1986	100	100	100	100	100	100
1987	100	100	100	100	100	100
1988	100	100	100	100	100	100
1989	100	100	100	100	100	100
1990	100	100	100	100	100	100
1991	100	100	100	100	100	100
1992	100	100	100	100	100	100
1993	100	100	100	100	100	100
1994	100	100	100	100	100	100
1995	100	100	100	100	100	100
1996	100	100	100	100	100	100
1997	100	100	100	100	100	100
1998	100	100	100	100	100	100
1999	100	100	100	100	100	100
2000	100	100	100	100	100	100
2001	100	100	100	100	100	100
2002	100	100	100	100	100	100
2003	100	100	100	100	100	100
2004	100	100	100	100	100	100
2005	100	100	100	100	100	100
2006	100	100	100	100	100	100
2007	100	100	100	100	100	100
2008	100	100	100	100	100	100
2009	100	100	100	100	100	100
2010	100	100	100	100	100	100
2011	100	100	100	100	100	100
2012	100	100	100	100	100	100
2013	100	100	100	100	100	100
2014	100	100	100	100	100	100
2015	100	100	100	100	100	100
2016	100	100	100	100	100	100
2017	100	100	100	100	100	100
2018	100	100	100	100	100	100
2019	100	100	100	100	100	100
2020	100	100	100	100	100	100
2021	100	100	100	100	100	100
2022	100	100	100	100	100	100
2023	100	100	100	100	100	100
2024	100	100	100	100	100	100
2025	100	100	100	100	100	100
2026	100	100	100	100	100	100
2027	100	100	100	100	100	100
2028	100	100	100	100	100	100
2029	100	100	100	100	100	100
2030	100	100	100	100	100	100
2031	100	100	100	100	100	100
2032	100	100	100	100	100	100
2033	100	100	100	100	100	100
2034	100	100	100	100	100	100
2035	100	100	100	100	100	100
2036	100	100	100	100	100	100
2037	100	100	100	100	100	100
2038	100	100	100	100	100	100
2039	100	100	100	100	100	100
2040	100	100	100	100	100	100
2041	100	100	100	100	100	100
2042	100	100	100	100	100	100
2043	100	100	100	100	100	100
2044	100	100	100	100	100	100
2045	100	100	100	100	100	100
2046	100	100	100	100	100	100
2047	100	100	100	100	100	100
2048	100	100	100	100	100	100
2049	100	100	100	100	100	100
2050	100	100	100	100	100	100
2051	100	100	100	100	100	100
2052	100	100	100	100	100	100
2053	100	100	100	100	100	100
2054	100	100	100	100	100	100
2055	100	100	100	100	100	100
2056	100	100	100	100	100	100
2057	100	100	100	100	100	100
2058	100	100	100	100	100	100
2059	100	100	100	100	100	100
2060	100	100	100	100	100	100
2061	100	100	100	100	100	100
2062	100	100	100	100	100	100
2063	100	100	100	100	100	100
2064	100	100	100	100	100	100
2065	100	100	100	100	100	100
2066	100	100	100	100	100	100
2067	100	100	100	100	100	100
2068	100	100	100	100	100	100
2069	100	100	100	100	100	100
2070	100	100	100	100	100	100
2071	100	100	100	100	100	100
2072	100	100	100	100	100	100
2073	100	100	100	100	100	100
2074	100	100	100	100	100	100
2075	100	100	100	100	100	100
2076	100	100	100	100	100	100
2077	100	100	100	100	100	100
2078	100	100	100	100	100	100
2079	100	100	100	100	100	100
2080	100	100	100	100	100	100
2081	100	100	100	100	100	100
2082	100	100	100	100	100	100
2083	100	100	100	100	100	100
2084	100	100	100	100	100	100
2085	100	100	100	100	100	100
2086	100	100	100	100	100	100
2087	100	100	100	100	100	100
2088	100	100	100	100	100	100
2089	100	100	100	100	100	100
2090	100	100	100	100	100	100
2091	100	100	100	100	100	100
2092	100	100	100	100	100	100
2093	100	100	100	100	100	100
2094	100	100	100	100	100	100
2095	100	100	100	100	100	100
2096	100	100	100	100	100	100
2097	100	100	100	100	100	100
2098	100	100	100	100	100	100
2099	100	100	100	100	100	100
2100	100	100	100	100	100	100

DATA INTERPOLATED
FROM TABLES 1—9

Bearing A

R. P. M. of Shaft 2000

Table No. 10

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500			
1350			
1200			
1050			
900	0.400	0.012	0.0080
750	0.315	0.0115	0.0075
600	0.315	0.0130	0.0085
450	0.255	0.0150	0.0097
300	0.175	0.0150	0.0097

Remarks:—



DATA INTERPOLATED
FROM TABLES 1—9

Bearing A

R. P. M. of Shaft 1600

Table No. 11

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.435	0.0095	0.0062
1350	0.390	0.0092	0.0060
1200	0.345	0.0095	0.0060
1050	0.316	0.0097	0.0062
900	0.265	0.010	0.0068
750	0.230	0.0105	0.0065
600	0.230	0.015	0.0075
450	0.180	0.0134	0.0085
300	0.125	0.0125	0.0080

Remarks:—

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80
81	82	83	84
85	86	87	88
89	90	91	92
93	94	95	96
97	98	99	100

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ A _____

R. P. M. of Shaft _____ 1200 _____

Table No. **12** _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.315	0.0088	0.0055
1350	0.280	0.0090	0.0058
1200	0.245	0.0090	0.0058
1050	0.225	0.0095	0.0060
900	0.190	0.0093	0.0058
750	0.162	0.0096	0.0060
600	0.151	0.0098	0.0065
450	0.120	0.012	0.0070
300	0.070	0.0097	0.0060

Remarks:—

TABLE I			
Summary of the results of the experiments			
Experiment	Time (min)	Temperature (°C)	Yield (%)
1	10	100	85
2	20	100	88
3	30	100	90
4	40	100	92
5	50	100	93
6	60	100	94
7	70	100	95
8	80	100	96
9	90	100	97
10	100	100	98
11	110	100	99
12	120	100	100
13	130	100	100
14	140	100	100
15	150	100	100
16	160	100	100
17	170	100	100
18	180	100	100
19	190	100	100
20	200	100	100
21	210	100	100
22	220	100	100
23	230	100	100
24	240	100	100
25	250	100	100
26	260	100	100
27	270	100	100
28	280	100	100
29	290	100	100
30	300	100	100
31	310	100	100
32	320	100	100
33	330	100	100
34	340	100	100
35	350	100	100
36	360	100	100
37	370	100	100
38	380	100	100
39	390	100	100
40	400	100	100
41	410	100	100
42	420	100	100
43	430	100	100
44	440	100	100
45	450	100	100
46	460	100	100
47	470	100	100
48	480	100	100
49	490	100	100
50	500	100	100
51	510	100	100
52	520	100	100
53	530	100	100
54	540	100	100
55	550	100	100
56	560	100	100
57	570	100	100
58	580	100	100
59	590	100	100
60	600	100	100
61	610	100	100
62	620	100	100
63	630	100	100
64	640	100	100
65	650	100	100
66	660	100	100
67	670	100	100
68	680	100	100
69	690	100	100
70	700	100	100
71	710	100	100
72	720	100	100
73	730	100	100
74	740	100	100
75	750	100	100
76	760	100	100
77	770	100	100
78	780	100	100
79	790	100	100
80	800	100	100
81	810	100	100
82	820	100	100
83	830	100	100
84	840	100	100
85	850	100	100
86	860	100	100
87	870	100	100
88	880	100	100
89	890	100	100
90	900	100	100
91	910	100	100
92	920	100	100
93	930	100	100
94	940	100	100
95	950	100	100
96	960	100	100
97	970	100	100
98	980	100	100
99	990	100	100
100	1000	100	100

DATA INTERPOLATED
FROM TABLES 1-9

Bearing _____ A _____

R. P. M. of Shaft _____ 800 _____

Table No. 13 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.21	0.0088	0.0055
1350	0.190	0.0095	0.0060
1200	0.165	0.0085	0.0055
1050	0.152	0.0092	0.0060
900	0.128	0.0090	0.0055
750	0.110	0.0092	0.0058
600	0.090	0.009	0.0059
450	0.075	0.0105	0.0065
300	0.038	0.0075	0.005

Remarks:—



DATA INTERPOLATED
FROM TABLES 1-9

Bearing _____ A _____

R. P. M. of Shaft _____ 600 _____

Table No. 14 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.164	0.009	0.0064
1350	0.150	0.010	0.0068
1200	0.125	0.009	0.0055
1050	0.115	0.009	0.0060
900	0.10	0.009	0.0055
750	0.085	0.0092	0.0060
600	0.065	0.0090	0.0058
450	0.056	0.0107	0.0065
300	0.025	0.0071	0.0048

Remarks:—



DATA INTERPOLATED
FROM TABLES 1—9

Bearing A

R. P. M. of Shaft 400

Table No. 15

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.115	0.0095	0.0063
1350	0.105	0.010	0.0068
1200	0.085	0.0098	0.0064
1050	0.080	0.0096	0.0063
900	0.068	0.0095	0.0060
750	0.057	0.0098	0.0063
600	0.045	0.0098	0.0060
450	0.042	0.013	0.0078
300	0.015	0.0077	0.0052

Remarks:—

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ A _____

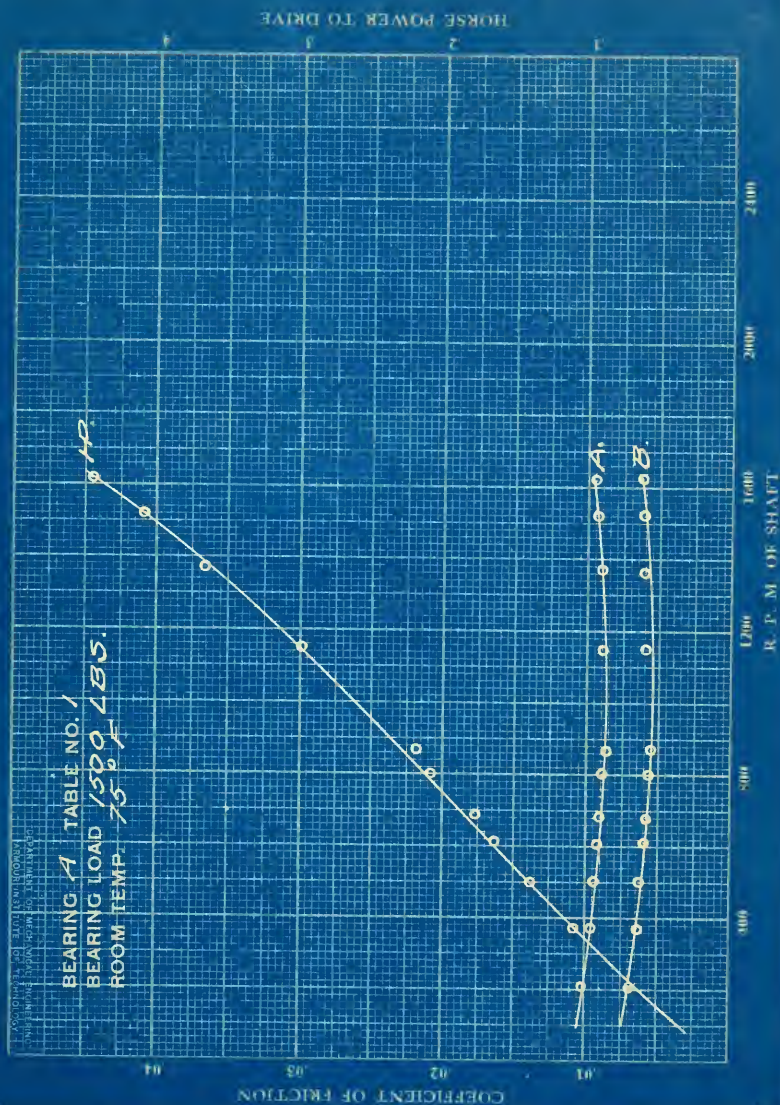
R. P. M. of Shaft _____ 200 _____

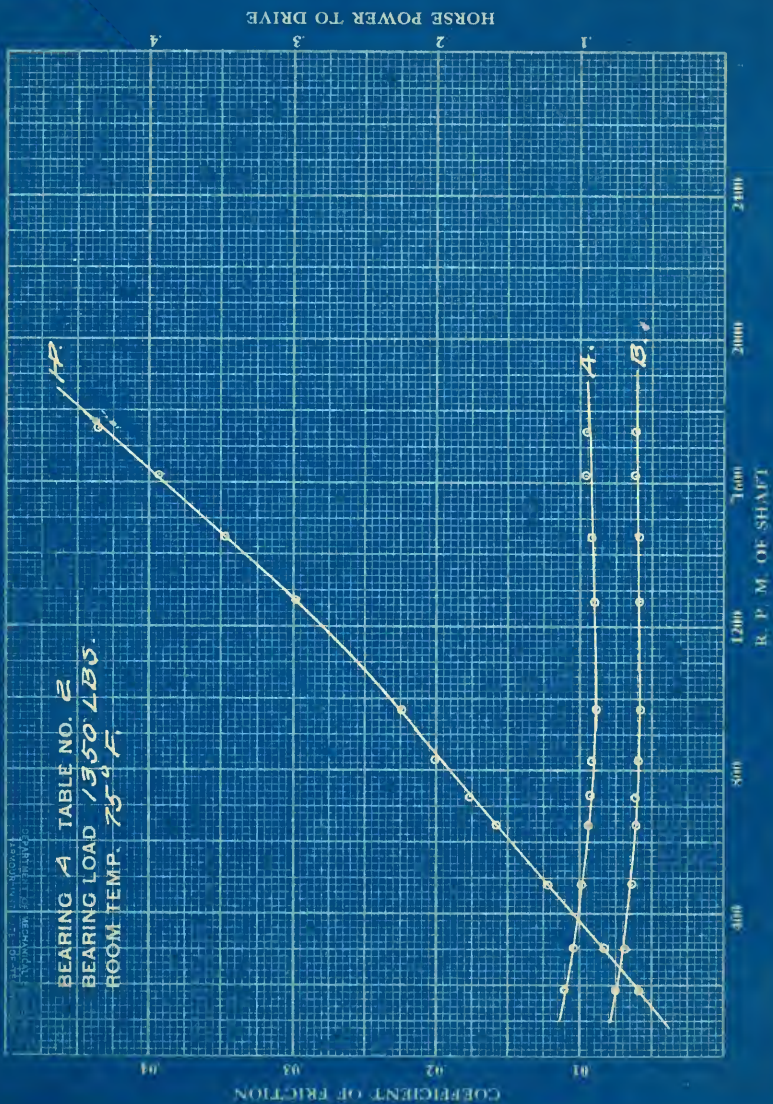
Table No. 16 _____

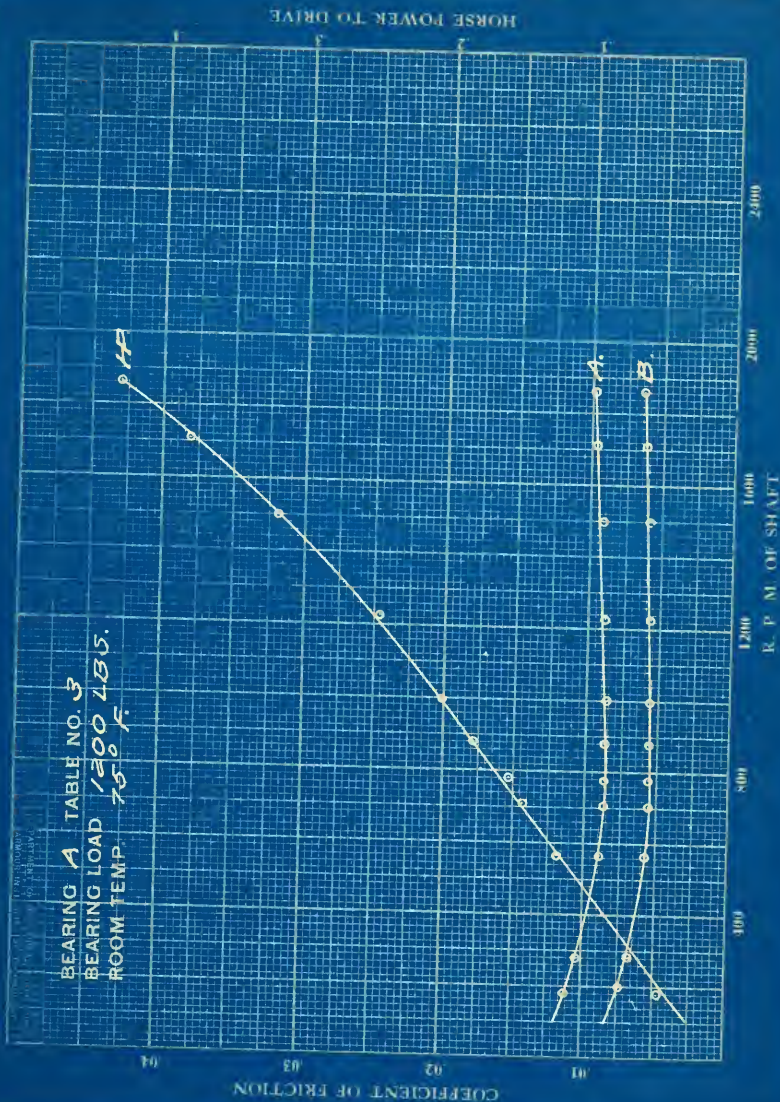
Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.063	0.01	0.007
1350	0.062	0.011	0.0075
1200	0.045	0.011	0.0075
1050	0.042	0.0115	0.0075
900	0.038	0.0110	0.0073
750	0.035	0.0114	0.0075
600	0.025	0.0113	0.0070
450	0.032	0.0185	0.012
300	0.010	0.010	0.0065

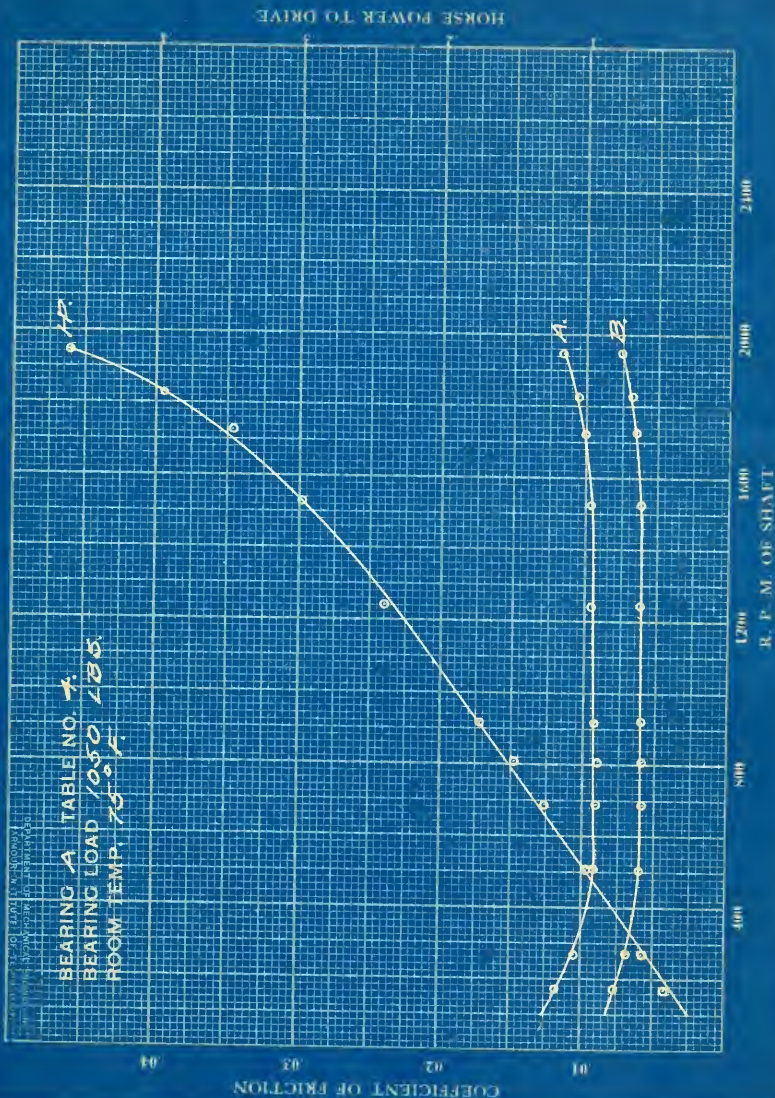
Remarks:—

CURVES PLOTTED FROM
TABLES 1 - 16
OF
BEARING "A"

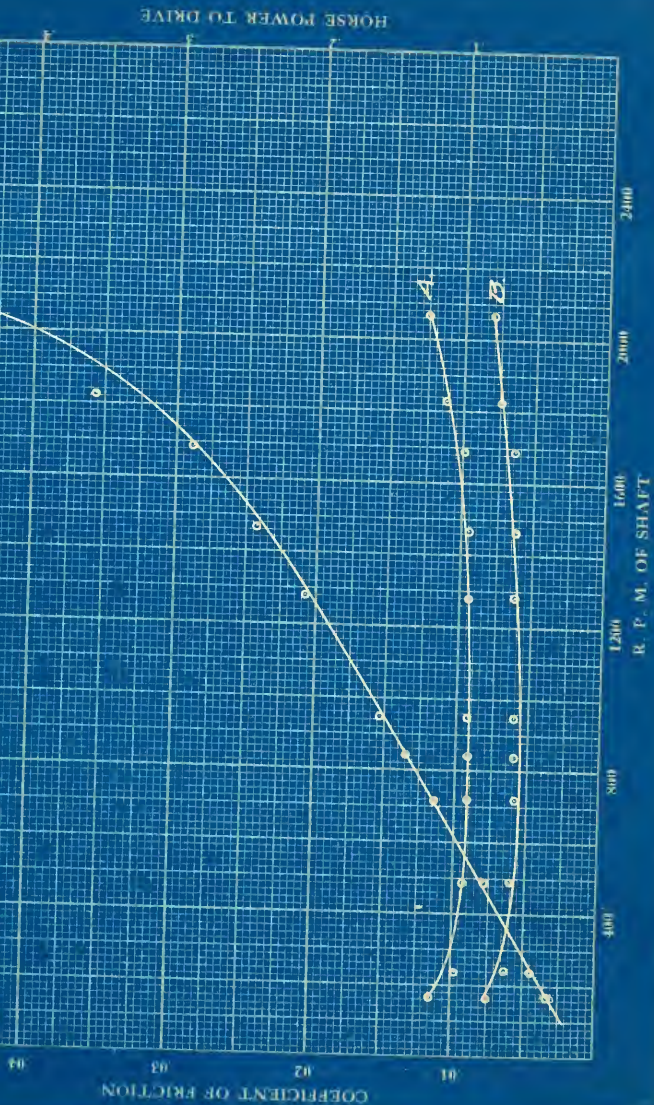








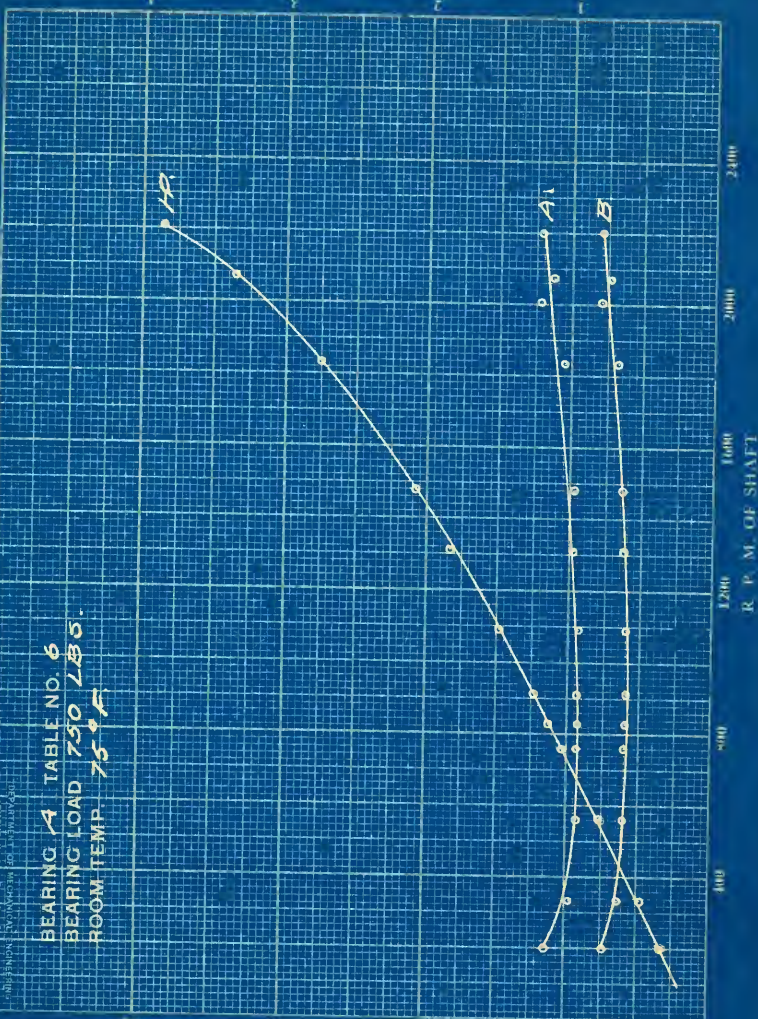
BEARING 4 TABLE NO. 5.
BEARING LOAD 900 LBS.
ROOM TEMP. 75°F.

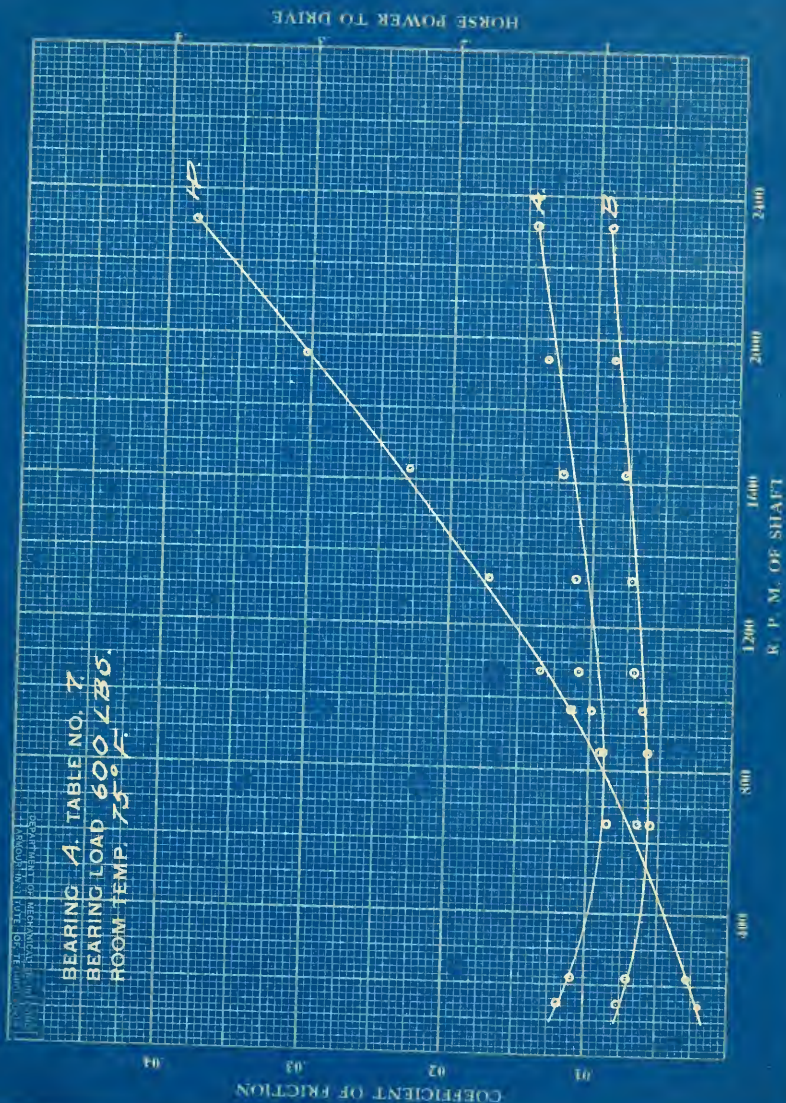


BEARING 4 TABLE NO. 6
 BEARING LOAD 750 LBS.
 ROOM TEMP. 75°F

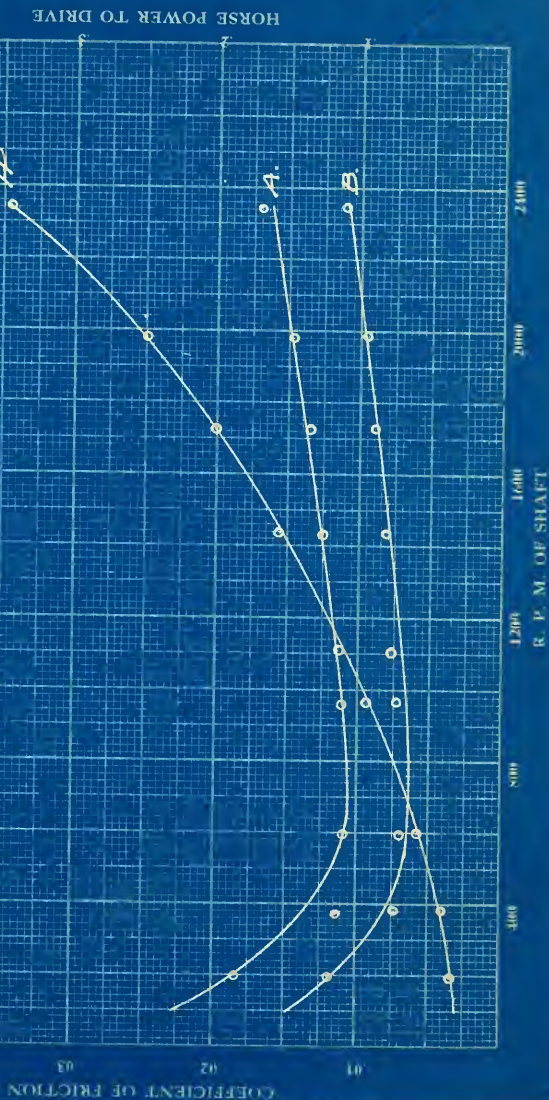
COEFFICIENT OF FRICTION

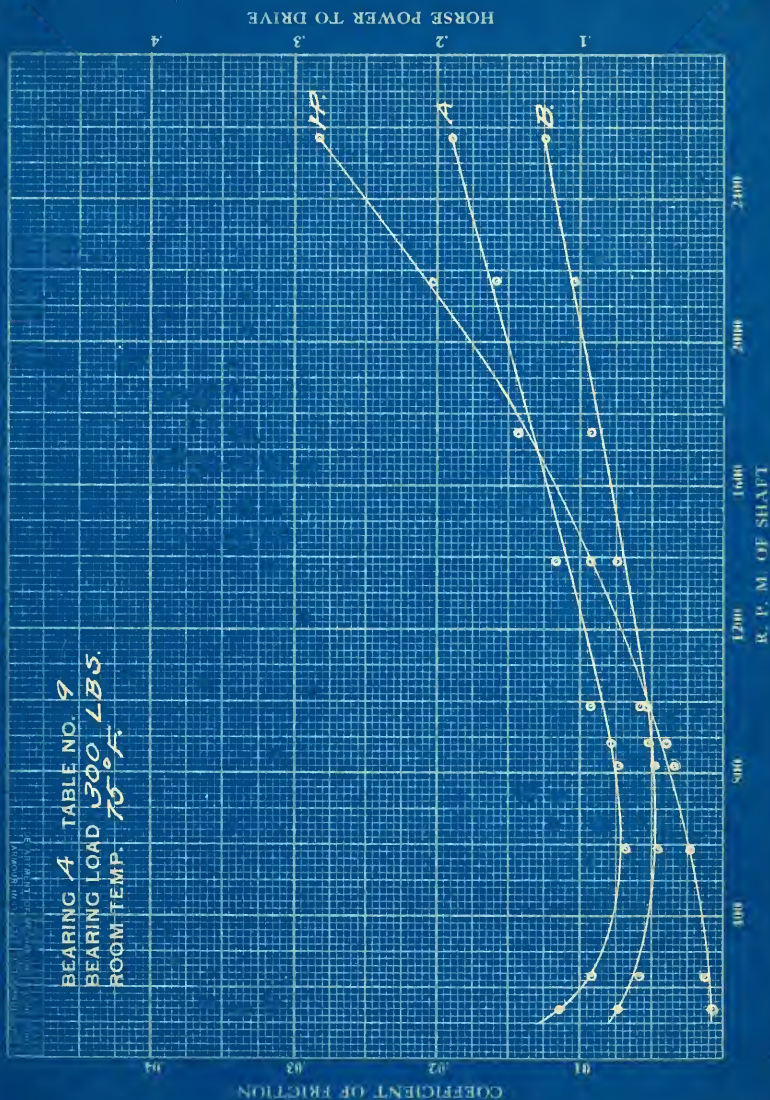
HORSE POWER TO DRIVE

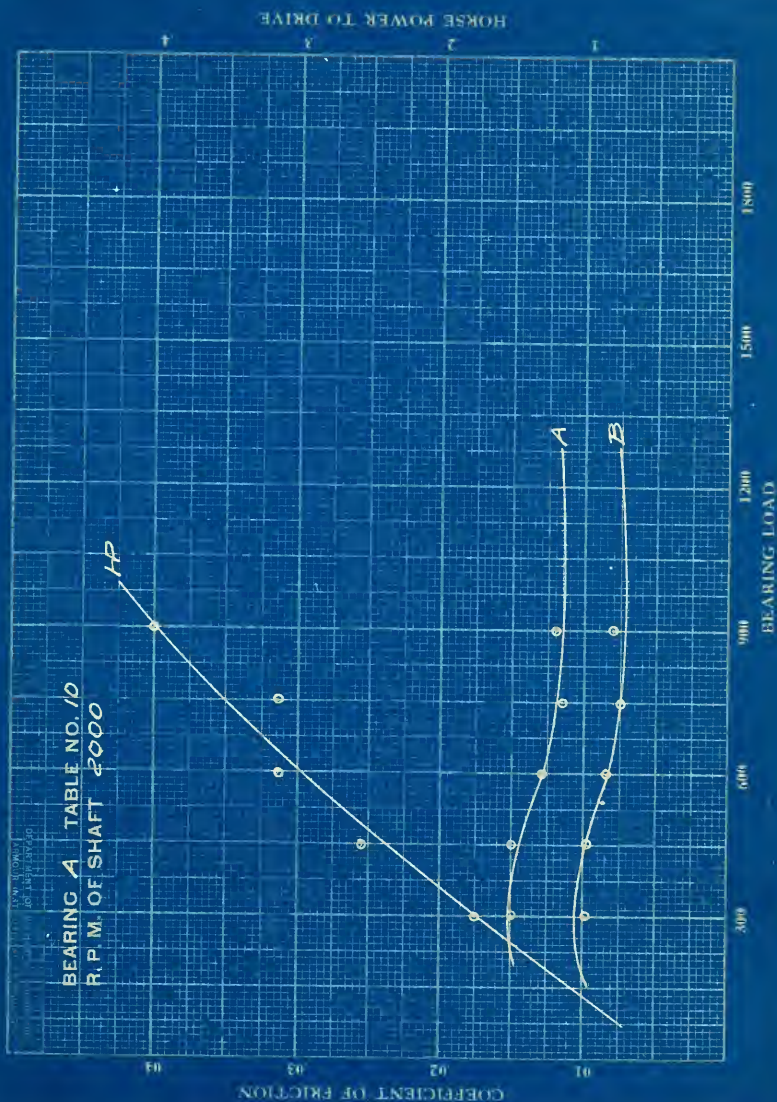


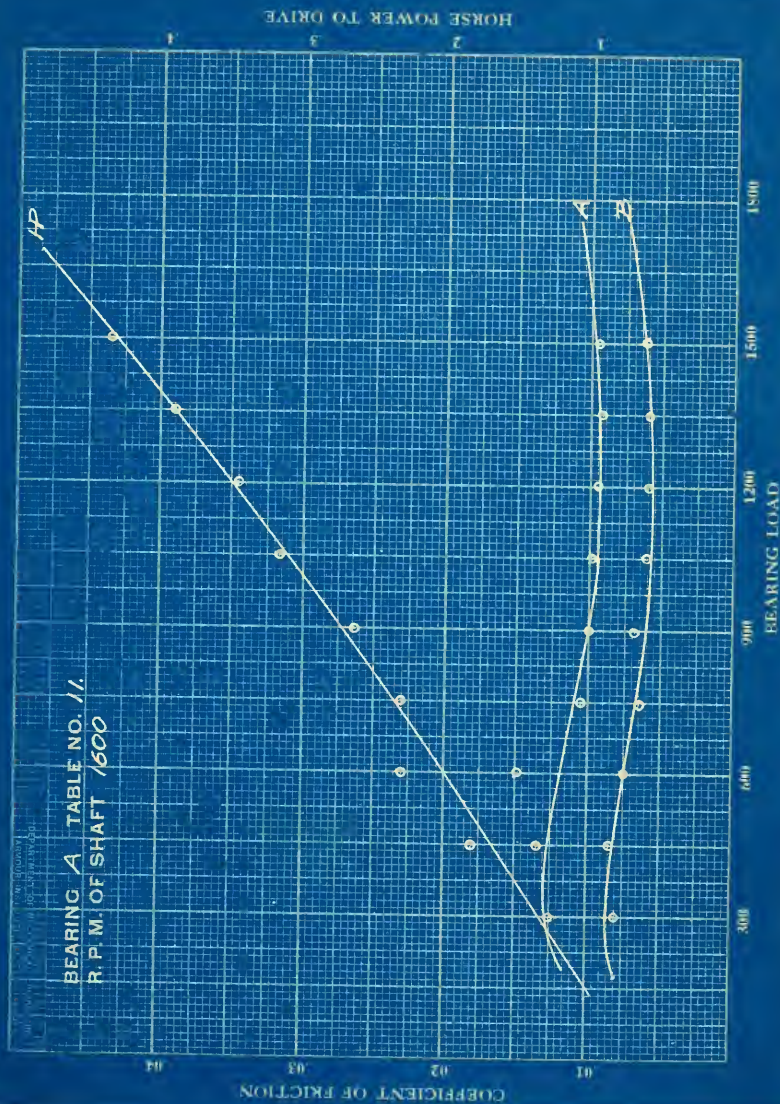


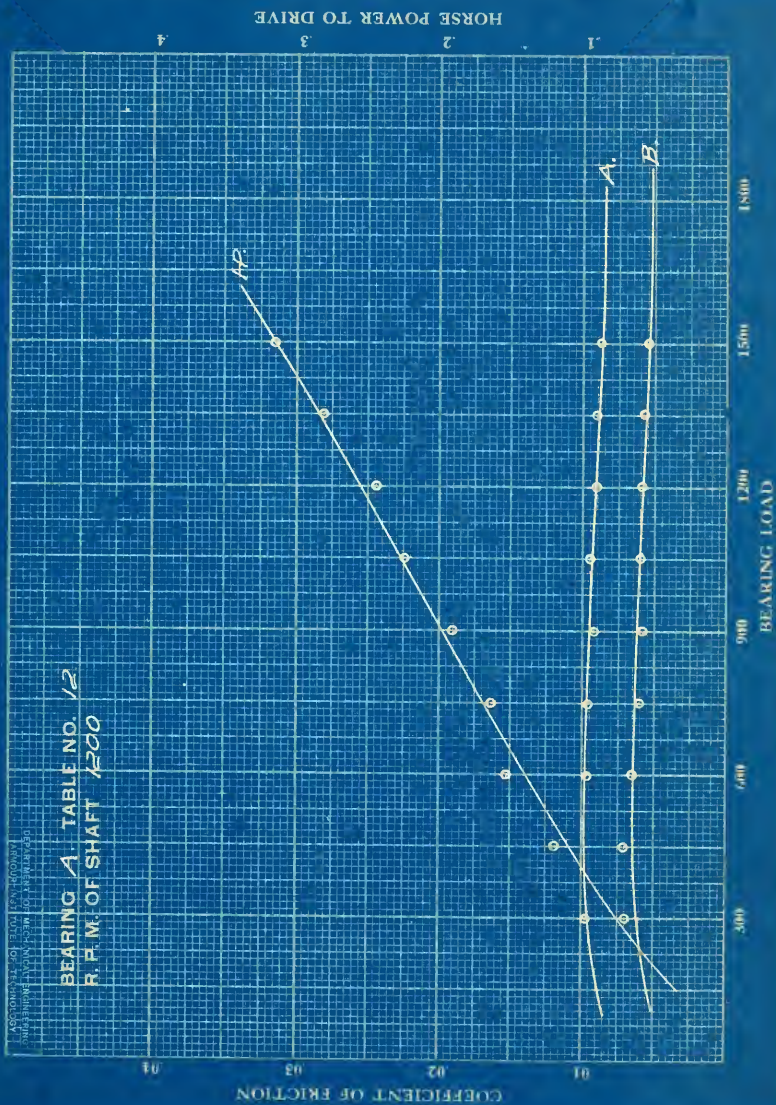
BEARING A. TABLE NO. 8.
BEARING LOAD 450 LBS.
ROOM TEMP. 72°F.

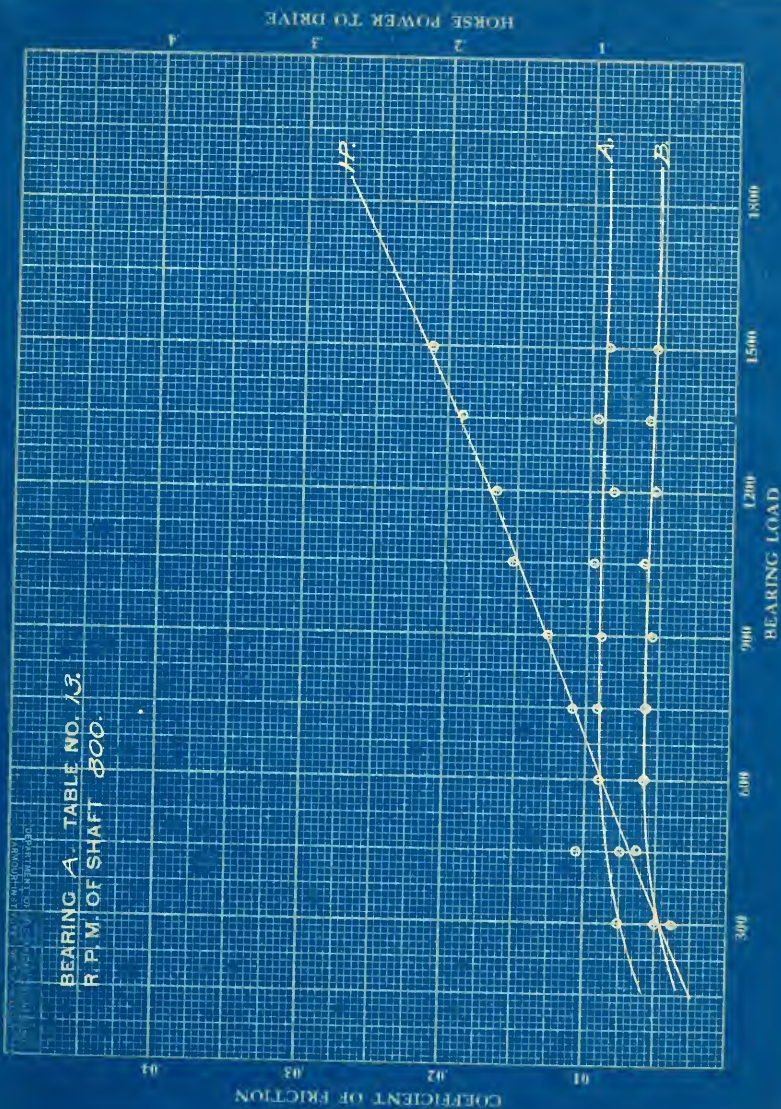




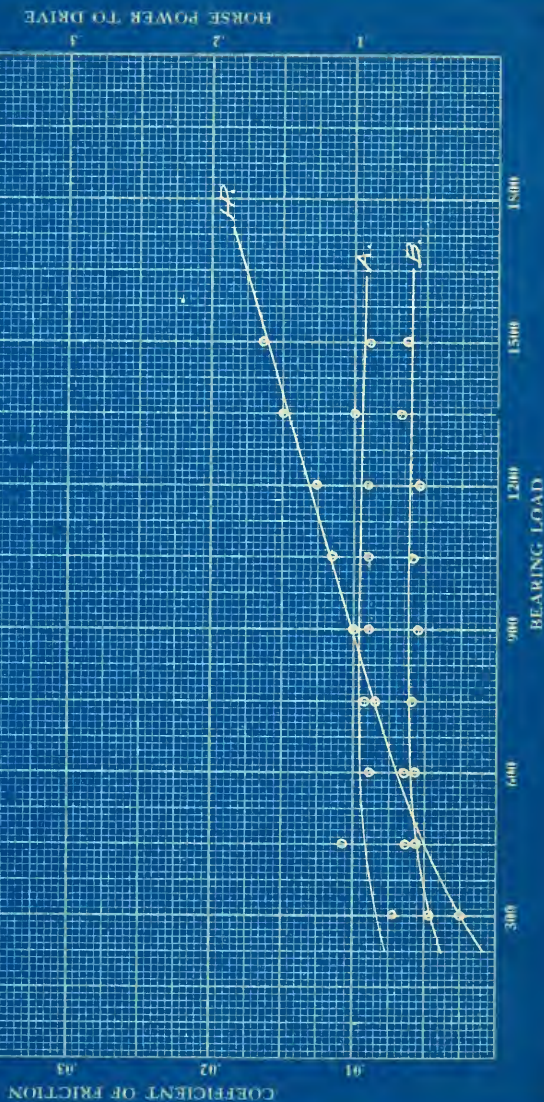




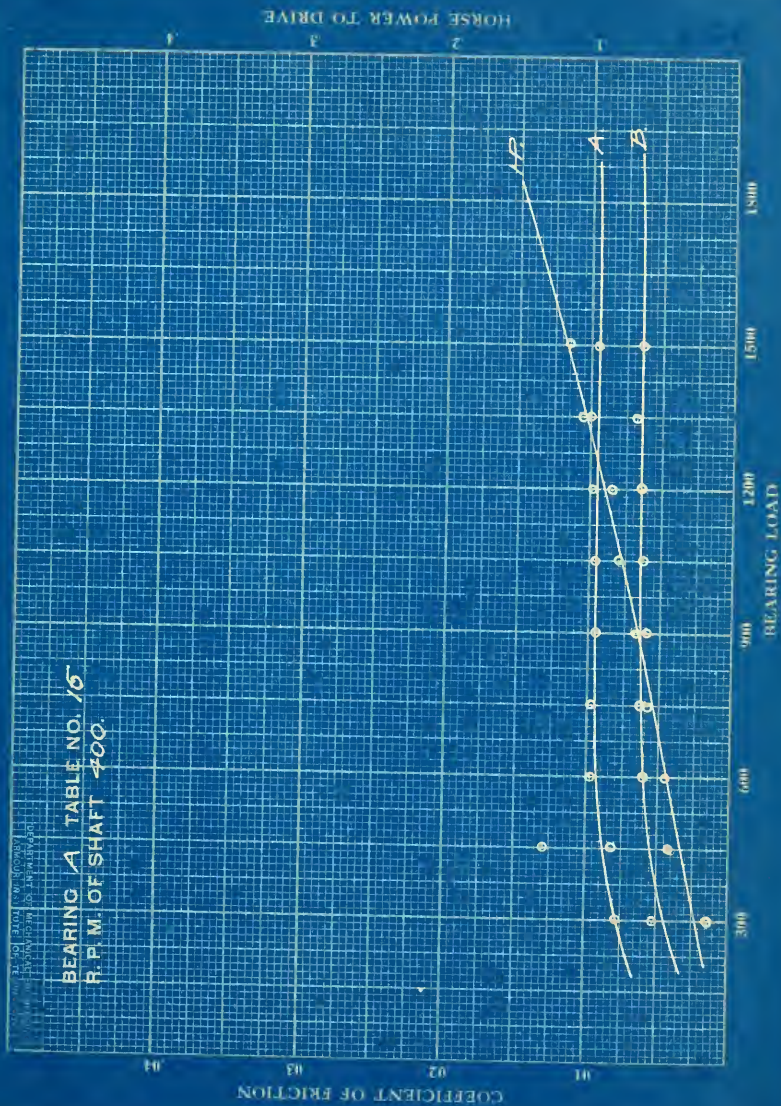


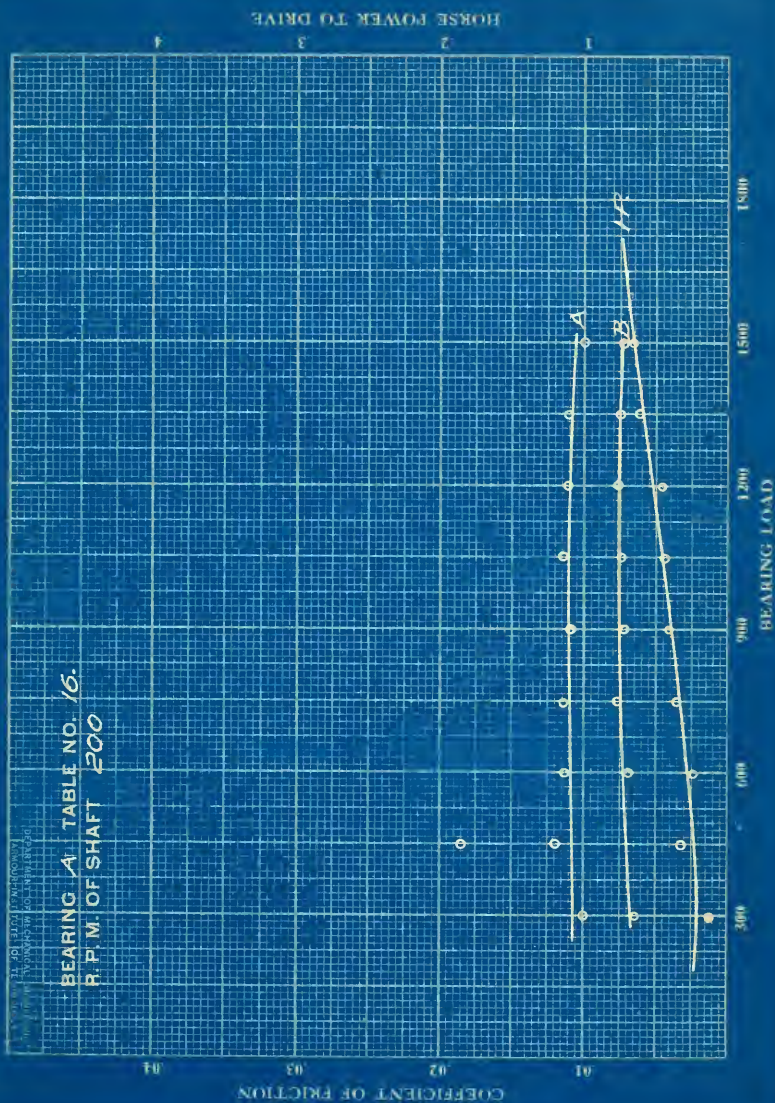


BEARING A, TABLE NO. 14.
R. P. M. OF SHAFT 600.



BEARING A TABLE NO. 16
R. P. M. OF SHAFT 400.





BEARING "B"

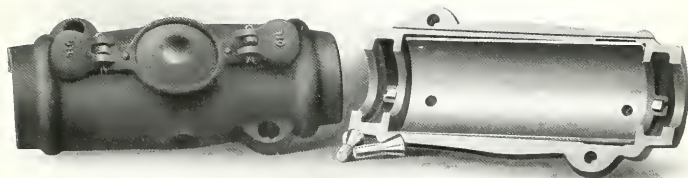


Fig. 6

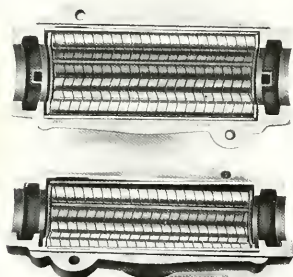


Fig. 7



Fig. 8

BEARING "B"

Bearing "B", (Figures 6,7,8), has as its distinctive feature, a flexible roller which is made from a strip of steel wound into a helical coil or spring of uniform diameter. There are eleven of the coiled rolls in each bearing, six of them coiled in the right hand direction and five in the left hand direction. (Fig.7) The rolls are held in a separator and they run directly on the shaft.

The box is of iron, cast in two parts and lined with steel; the steel serving the purpose of an outer raceway for the rolls. (Fig.6)

The greatest advantage of a roller of this construction is, that it is flexible, which enables it to present a bearing surface along its entire length resulting in a uniform distribution of the load. The roller adjusts itself to any irregularity in the rubbing surface. The roller being hollow acts as an

The first of these is the fact that the
 distribution of the population is not uniform
 over the whole of the country. It is more
 concentrated in certain districts, and less
 so in others. This is due to a variety of
 causes, some of which are physical, and
 others are social. The physical causes
 are the result of the unevenness of the
 surface of the country, and the social
 causes are the result of the different
 degrees of civilization and of the
 different degrees of wealth. The result
 is that the population is more densely
 packed in some districts than in others,
 and that the distribution of the
 population is not uniform over the whole
 of the country.

oil reservoir, thereby, assuring good lubrication at all times.

These bearings could not be run over seven hundred revolutions, it being the claim of the firm manufacturing this bearing that it is built only for ordinary line shaft purposes; in other words, at speeds of 300 to 400 R.P.M.

At such speeds these bearings showed a tendency to heat up, but, not to any great extent on the lighter loads.

These rollers can be made longer than a solid roller, because, they are flexible, whereas, a solid roll does not bend to the deflection of the shaft. But, there is a disadvantage to this roller just as there is to the solid ones. It requires power to flex a spring, therefore, the constant working of these resilient rolls to allow for irregularities of alignment and surface must absorb an appreciable amount of power which is dissipated as heat.

TABLES 1 - 13
OF
BEARING "B"

BEARING B

Table No. 1 Date July 6th, 1915.

Bearing Load, LBS. 1500 Time, beginning of run 10:06 A.M.

Room Temp.° Fahr. 72 Time, end of run 10:30 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 3 1/2 in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.68	745	21.40	0.253	0.0117	0.0089
0.65	653	20.48	0.212	0.0112	0.0085
0.62	632	19.52	0.196	0.0107	0.0081
0.595	617	18.72	0.184	0.0103	0.0078
0.58	603	18.26	0.175	0.0100	0.0076
0.54	559	17.00	0.151	0.0093	0.0071
0.525	456	16.51	0.120	0.0091	0.0069
0.495	443	15.58	0.110	0.0085	0.0064
0.45	390	14.16	0.088	0.0078	0.0059
0.42	328	13.23	0.069	0.0073	0.0055
0.39	283	12.28	0.055	0.0061	0.0051
0.305	224	11.50	0.041	0.0063	0.0048
0.35	178	11.00	0.031	0.0060	0.0046

Remarks:—

TABLE 1

Summary of data

for the year 1960

Source: U.S. Department of Commerce, Bureau of Economic Analysis

Notes: All figures are in millions of dollars unless otherwise indicated

Continued

TABLE 1

Category	Subcategory	Value	Percentage	Ratio	Index
Personal consumption	Food	100.0	100.0	1.00	100.0
Personal consumption	Alcohol	10.0	10.0	0.10	100.0
Personal consumption	Other	90.0	90.0	0.90	100.0
Business consumption	Food	10.0	10.0	0.10	100.0
Business consumption	Alcohol	1.0	1.0	0.01	100.0
Business consumption	Other	9.0	9.0	0.09	100.0
Government consumption	Food	10.0	10.0	0.10	100.0
Government consumption	Alcohol	1.0	1.0	0.01	100.0
Government consumption	Other	9.0	9.0	0.09	100.0
Total consumption	Food	30.0	30.0	0.30	100.0
Total consumption	Alcohol	2.0	2.0	0.02	100.0
Total consumption	Other	28.0	28.0	0.28	100.0
Investment	Food	10.0	10.0	0.10	100.0
Investment	Alcohol	1.0	1.0	0.01	100.0
Investment	Other	9.0	9.0	0.09	100.0
Government saving	Food	10.0	10.0	0.10	100.0
Government saving	Alcohol	1.0	1.0	0.01	100.0
Government saving	Other	9.0	9.0	0.09	100.0
Private saving	Food	10.0	10.0	0.10	100.0
Private saving	Alcohol	1.0	1.0	0.01	100.0
Private saving	Other	9.0	9.0	0.09	100.0
Total saving	Food	20.0	20.0	0.20	100.0
Total saving	Alcohol	2.0	2.0	0.02	100.0
Total saving	Other	18.0	18.0	0.18	100.0

B E A R I N G B

Table No. 2 Date July 6th, 1915.

Bearing Load, LBS. 1350 Time, beginning of run 10:30 A.M.

Room Temp.° Fahr. 72 Time, end of run 11:10 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.585	729	18.41	0.213	0.0112	0.0085	
0.56	708	17.65	0.198	0.0107	0.0081	
0.535	657	16.85	0.176	0.0102	0.0077	
0.51	633	16.07	0.161	0.0098	0.0074	
0.49	599	15.42	0.147	0.0094	0.0071	
0.455	536	14.35	0.122	0.0087	0.0066	
0.42	495	13.22	0.104	0.0080	0.0061	
0.39	410	12.28	0.080	0.0075	0.0057	
0.365	373	11.48	0.068	0.0070	0.0053	
0.335	271	10.54	0.045	0.0064	0.0048	
0.31	207	9.76	0.032	0.0059	0.0045	
0.30	174	9.45	0.026	0.0057	0.0043	

Remarks:—

B E A R I N G B

Table No. 3 Date July 6th, 1915.

Bearing Load, LBS. 1200 Time, beginning of run 11:18 A.M.

Room Temp.° Fahr. 72 Time, end of run 11:30 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.555	771	17.50	0.214	0.0120	0.0091
0.50	689	15.75	0.172	0.0108	0.0082
0.48	662	15.12	0.159	0.0103	0.0078
0.45	611	14.18	0.137	0.0094	0.0071
0.395	510	12.45	0.101	0.0085	0.0064
0.36	436	11.34	0.079	0.0078	0.0059
0.305	262	9.62	0.040	0.0066	0.0050
0.285	183	8.97	0.026	0.0061	0.0046

Remarks:—

B E A R I N G B

Table No. 4 Date July 6th, 1915.

Bearing Load, LBS. 1050 Time, beginning of run 11:30 A.M.

Room Temp.° Fahr. 72 Time, end of run 11:46 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.495	758	15.57	0.188	0.0122	0.0092
0.45	674	14.18	0.152	0.0111	0.0084
0.425	628	13.38	0.133	0.0105	0.0079
0.40	589	12.58	0.118	0.0099	0.0075
0.37	524	11.64	0.097	0.0091	0.0069
0.315	400	9.92	0.063	0.0078	0.0059
0.28	285	8.82	0.040	0.0069	0.0052
0.25	196	7.87	0.025	0.0062	0.0047

Remarks:—

TABLE 1

Summary of Results

Page 10

1. The first row of the table shows the results of the first experiment.

2. The second row of the table shows the results of the second experiment.

3. The third row of the table shows the results of the third experiment.

4. The fourth row of the table shows the results of the fourth experiment.

5. The fifth row of the table shows the results of the fifth experiment.

6. The sixth row of the table shows the results of the sixth experiment.

7. The seventh row of the table shows the results of the seventh experiment.

8. The eighth row of the table shows the results of the eighth experiment.

9. The ninth row of the table shows the results of the ninth experiment.

10. The tenth row of the table shows the results of the tenth experiment.

11. The eleventh row of the table shows the results of the eleventh experiment.

12. The twelfth row of the table shows the results of the twelfth experiment.

13. The thirteenth row of the table shows the results of the thirteenth experiment.

14. The fourteenth row of the table shows the results of the fourteenth experiment.

15. The fifteenth row of the table shows the results of the fifteenth experiment.

16. The sixteenth row of the table shows the results of the sixteenth experiment.

17. The seventeenth row of the table shows the results of the seventeenth experiment.

18. The eighteenth row of the table shows the results of the eighteenth experiment.

19. The nineteenth row of the table shows the results of the nineteenth experiment.

20. The twentieth row of the table shows the results of the twentieth experiment.

21. The twenty-first row of the table shows the results of the twenty-first experiment.

22. The twenty-second row of the table shows the results of the twenty-second experiment.

23. The twenty-third row of the table shows the results of the twenty-third experiment.

24. The twenty-fourth row of the table shows the results of the twenty-fourth experiment.

25. The twenty-fifth row of the table shows the results of the twenty-fifth experiment.

BEARING B

Table No. 5 Date July 6th, 1915.

Bearing Load, LBS. 900 Time, beginning of run 11:46 A.M.

Room Temp.° Fahr. 72 Time, end of run 11:56 A.M.

Observers _____

NOTE:—All data average of four bearings.

[illegible]

Remarks:—

Table 1

Summary of the results of the regression analysis for the dependent variable Y_i

where Y_i is the dependent variable, X_i is the vector of independent variables, β_0 is the intercept, $\beta_1, \beta_2, \dots, \beta_k$ are the coefficients of the independent variables, and ϵ_i is the error term.

The results of the regression analysis are presented in Table 1. The dependent variable is Y_i , and the independent variables are X_1, X_2, \dots, X_k .

Variable	Mean	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis
Y_i	1.23	0.45	0.00	2.00	0.12	3.00
X_1	0.50	0.20	0.00	1.00	0.00	3.00
X_2	0.75	0.25	0.00	1.00	0.00	3.00
X_3	0.25	0.15	0.00	0.50	0.00	3.00
X_4	0.50	0.20	0.00	1.00	0.00	3.00
X_5	0.75	0.25	0.00	1.00	0.00	3.00
X_6	0.25	0.15	0.00	0.50	0.00	3.00
X_7	0.50	0.20	0.00	1.00	0.00	3.00
X_8	0.75	0.25	0.00	1.00	0.00	3.00
X_9	0.25	0.15	0.00	0.50	0.00	3.00
X_{10}	0.50	0.20	0.00	1.00	0.00	3.00

BEARING B

Table No. 6 Date July 6th, 1915.

Bearing Load, LBS. 750 Time, beginning of run 11:56 A.M.

Room Temp.° Fahr. 72 Time, end of run 12:10 P.M.

Observers

NOTE:—All data average of four bearings.

[illegible]

Remarks:—

B E A R I N G B

Table No. 7 Date July 6th, 1915.

Bearing Load, LBS. 600 Time, beginning of run 12:10 P.M.

Room Temp.° Fahr. 72 Time, end of run 12:30 P.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.41	719	12.89		0.147	0.0176	0.0133
0.375	672	11.79		0.126	0.0161	0.0122
0.335	574	10.53		0.096	0.0144	0.0109
0.30	493	9.45		0.074	0.0129	0.0098
0.255	329	8.03		0.042	0.0110	0.0083
0.255	334	8.03		0.043	0.0110	0.0083
0.24	305	7.55		0.037	0.0103	0.0078
0.225	274	7.08		0.031	0.0097	0.0073
0.215	217	6.76		0.023	0.0093	0.0070
0.20	155	6.29		0.016	0.0086	0.0065

Remarks:—

Table 1. Summary of data for the first 1000 cases.

The following table shows the distribution of cases by age group and sex. The data is presented in a 2x10 grid. The first column shows the age group, and the second column shows the number of cases. The third column shows the percentage of cases, and the fourth column shows the total number of cases. The fifth column shows the number of cases by sex, and the sixth column shows the percentage of cases by sex. The seventh column shows the number of cases by sex, and the eighth column shows the percentage of cases by sex. The ninth column shows the number of cases by sex, and the tenth column shows the percentage of cases by sex.

Age Group	Number of Cases	Percentage of Cases	Total Number of Cases	Number of Cases by Sex	Percentage of Cases by Sex	Number of Cases by Sex	Percentage of Cases by Sex	Number of Cases by Sex	Percentage of Cases by Sex
0-4	100	10.0%	1000	50	5.0%	50	5.0%	50	5.0%
5-9	150	15.0%	1000	75	7.5%	75	7.5%	75	7.5%
10-14	200	20.0%	1000	100	10.0%	100	10.0%	100	10.0%
15-19	250	25.0%	1000	125	12.5%	125	12.5%	125	12.5%
20-24	300	30.0%	1000	150	15.0%	150	15.0%	150	15.0%
25-29	350	35.0%	1000	175	17.5%	175	17.5%	175	17.5%
30-34	400	40.0%	1000	200	20.0%	200	20.0%	200	20.0%
35-39	450	45.0%	1000	225	22.5%	225	22.5%	225	22.5%
40-44	500	50.0%	1000	250	25.0%	250	25.0%	250	25.0%
45-49	550	55.0%	1000	275	27.5%	275	27.5%	275	27.5%

B E A R I N G B

Table No. 8 Date July 6th, 1915.

Bearing Load, LBS. 450 Time, beginning of run 12:30 P.M.

Room Temp.° Fahr. 72 Time, end of run 12:45 P.M.

Observers	
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NOTE:—All data average of four bearings.

[illegible]

Remarks:—

B E A R I N G B

Table No. 9 Date July 6th, 1915.

Bearing Load, LBS. 300 Time, beginning of run 12:45 P.M.

Room Temp.° Fahr. 72 Time, end of run 12:55 P.M.

Observers _____

NOTE:—All data average of four bearings.

[illegible]

Remarks:—

1000	1000	1000	1000	1000	1000
2000	2000	2000	2000	2000	2000
3000	3000	3000	3000	3000	3000
4000	4000	4000	4000	4000	4000
5000	5000	5000	5000	5000	5000
6000	6000	6000	6000	6000	6000
7000	7000	7000	7000	7000	7000
8000	8000	8000	8000	8000	8000
9000	9000	9000	9000	9000	9000

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ B _____

R. P. M. of Shaft _____ 800 _____

Table No. 10 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500		0.0120	0.0097
1350		0.0120	0.0097
1200	0.23	0.0120	0.0095
1050	0.223	0.0130	0.0098
900	0.210	0.0147	0.0115
750	0.195	0.0160	0.0125
600	0.195	0.0135	0.0140
450	0.185	0.025	0.0193
300	0.160	0.036	0.026

Remarks:—



DATA INTERPOLATED
FROM TABLES 1—9

Bearing B

R. P. M. of Shaft 600

Table No. 11

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.170	0.0100	0.0077
1350	0.14	0.0092	0.0072
1200	0.135	0.0092	0.0070
1050	0.120	0.010	0.0075
900	0.1150	0.0115	0.0085
750	0.110	0.0123	0.0095
600	0.105	0.0148	0.011
450	0.100	0.0190	0.0142
300	0.092	0.0262	0.020

Remarks:—

TABLE I			
Summary of the results of the experiments			
Experiment	Material	Time (min)	Result
1	Aluminum	10	100%
2	Aluminum	20	100%
3	Aluminum	30	100%
4	Aluminum	40	100%
5	Aluminum	50	100%
6	Aluminum	60	100%
7	Aluminum	70	100%
8	Aluminum	80	100%
9	Aluminum	90	100%
10	Aluminum	100	100%
11	Aluminum	110	100%
12	Aluminum	120	100%
13	Aluminum	130	100%
14	Aluminum	140	100%
15	Aluminum	150	100%
16	Aluminum	160	100%
17	Aluminum	170	100%
18	Aluminum	180	100%
19	Aluminum	190	100%
20	Aluminum	200	100%
21	Aluminum	210	100%
22	Aluminum	220	100%
23	Aluminum	230	100%
24	Aluminum	240	100%
25	Aluminum	250	100%
26	Aluminum	260	100%
27	Aluminum	270	100%
28	Aluminum	280	100%
29	Aluminum	290	100%
30	Aluminum	300	100%
31	Aluminum	310	100%
32	Aluminum	320	100%
33	Aluminum	330	100%
34	Aluminum	340	100%
35	Aluminum	350	100%
36	Aluminum	360	100%
37	Aluminum	370	100%
38	Aluminum	380	100%
39	Aluminum	390	100%
40	Aluminum	400	100%
41	Aluminum	410	100%
42	Aluminum	420	100%
43	Aluminum	430	100%
44	Aluminum	440	100%
45	Aluminum	450	100%
46	Aluminum	460	100%
47	Aluminum	470	100%
48	Aluminum	480	100%
49	Aluminum	490	100%
50	Aluminum	500	100%
51	Aluminum	510	100%
52	Aluminum	520	100%
53	Aluminum	530	100%
54	Aluminum	540	100%
55	Aluminum	550	100%
56	Aluminum	560	100%
57	Aluminum	570	100%
58	Aluminum	580	100%
59	Aluminum	590	100%
60	Aluminum	600	100%
61	Aluminum	610	100%
62	Aluminum	620	100%
63	Aluminum	630	100%
64	Aluminum	640	100%
65	Aluminum	650	100%
66	Aluminum	660	100%
67	Aluminum	670	100%
68	Aluminum	680	100%
69	Aluminum	690	100%
70	Aluminum	700	100%
71	Aluminum	710	100%
72	Aluminum	720	100%
73	Aluminum	730	100%
74	Aluminum	740	100%
75	Aluminum	750	100%
76	Aluminum	760	100%
77	Aluminum	770	100%
78	Aluminum	780	100%
79	Aluminum	790	100%
80	Aluminum	800	100%
81	Aluminum	810	100%
82	Aluminum	820	100%
83	Aluminum	830	100%
84	Aluminum	840	100%
85	Aluminum	850	100%
86	Aluminum	860	100%
87	Aluminum	870	100%
88	Aluminum	880	100%
89	Aluminum	890	100%
90	Aluminum	900	100%
91	Aluminum	910	100%
92	Aluminum	920	100%
93	Aluminum	930	100%
94	Aluminum	940	100%
95	Aluminum	950	100%
96	Aluminum	960	100%
97	Aluminum	970	100%
98	Aluminum	980	100%
99	Aluminum	990	100%
100	Aluminum	1000	100%

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ B _____

R. P. M. of Shaft _____ 400 _____

Table No. 12 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.09	0.008	0.006
1350	0.065	0.0073	0.0055
1200	0.070	0.0075	0.0054
1050	0.063	0.0080	0.0055
900	0.057	0.0090	0.0065
750	0.055	0.0095	0.0075
600	0.052	0.0115	0.0065
450	0.048	0.0145	0.0108
300	0.045	0.020	0.0150

Remarks:—

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	12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DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ B _____

R. P. M. of Shaft _____ 200 _____

Table No. 13 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.042	0.0068	0.0050
1350	0.025	0.0060	0.0045
1200	0.032	0.0063	0.0045
1050	0.028	0.0065	0.0045
900	0.023	0.0075	0.0052
750	0.023	0.0080	0.0060
600	0.022	0.0095	0.0068
450	0.020	0.0117	0.0086
300	0.020	0.016	0.0120

Remarks:—

TABLE I			
Summary of the results of the experiments			
Experiment	Number of subjects	Number of trials	Number of correct responses
1	10	100	80
2	10	100	80
3	10	100	80
4	10	100	80
5	10	100	80
6	10	100	80
7	10	100	80
8	10	100	80
9	10	100	80
10	10	100	80
11	10	100	80
12	10	100	80
13	10	100	80
14	10	100	80
15	10	100	80
16	10	100	80
17	10	100	80
18	10	100	80
19	10	100	80
20	10	100	80
21	10	100	80
22	10	100	80
23	10	100	80
24	10	100	80
25	10	100	80
26	10	100	80
27	10	100	80
28	10	100	80
29	10	100	80
30	10	100	80
31	10	100	80
32	10	100	80
33	10	100	80
34	10	100	80
35	10	100	80
36	10	100	80
37	10	100	80
38	10	100	80
39	10	100	80
40	10	100	80
41	10	100	80
42	10	100	80
43	10	100	80
44	10	100	80
45	10	100	80
46	10	100	80
47	10	100	80
48	10	100	80
49	10	100	80
50	10	100	80
51	10	100	80
52	10	100	80
53	10	100	80
54	10	100	80
55	10	100	80
56	10	100	80
57	10	100	80
58	10	100	80
59	10	100	80
60	10	100	80
61	10	100	80
62	10	100	80
63	10	100	80
64	10	100	80
65	10	100	80
66	10	100	80
67	10	100	80
68	10	100	80
69	10	100	80
70	10	100	80
71	10	100	80
72	10	100	80
73	10	100	80
74	10	100	80
75	10	100	80
76	10	100	80
77	10	100	80
78	10	100	80
79	10	100	80
80	10	100	80
81	10	100	80
82	10	100	80
83	10	100	80
84	10	100	80
85	10	100	80
86	10	100	80
87	10	100	80
88	10	100	80
89	10	100	80
90	10	100	80
91	10	100	80
92	10	100	80
93	10	100	80
94	10	100	80
95	10	100	80
96	10	100	80
97	10	100	80
98	10	100	80
99	10	100	80
100	10	100	80

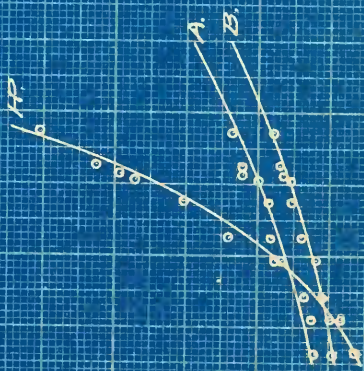
CURVES PLOTTED FROM
TABLES 1 - 13
OF
BEARING "B"

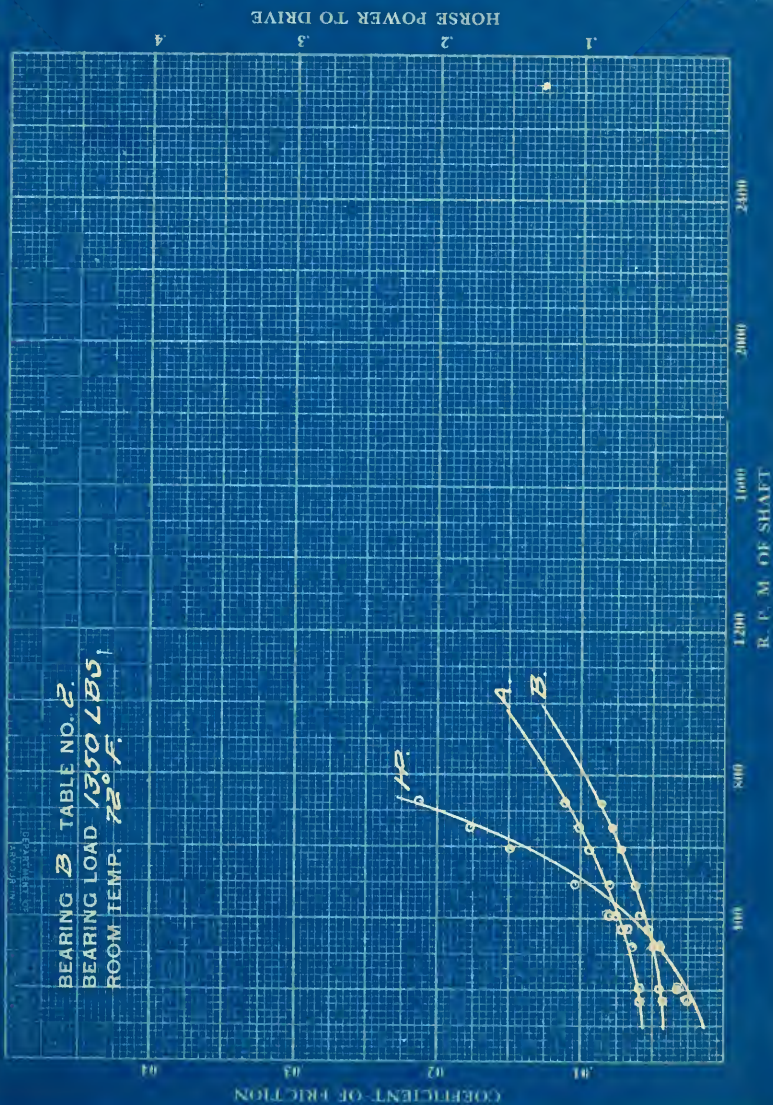
COEFFICIENT OF FRICTION

BEARING B. TABLE NO. 1.
BEARING LOAD 1500 LBS.
ROOM TEMP. 72° F.

HORSE POWER TO DRIVE

R. P. M. OF SHAFT



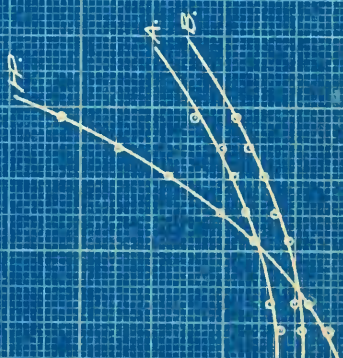


BEARING B. TABLE NO. 3.
 BEARING LOAD 1200 LBS.
 ROOM TEMP. 72° F.

HORSE POWER TO DRIVE

COEFFICIENT OF FRICTION

R. P. M. OF SHAFT



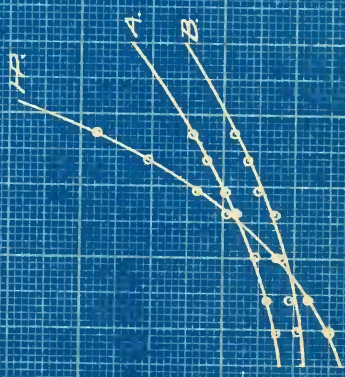
ACCORDING TO DATA FURNISHED BY
 THE BUSH-BROWN ENGINEERING CO.
 100 PARK STREET, NEW YORK, N. Y.

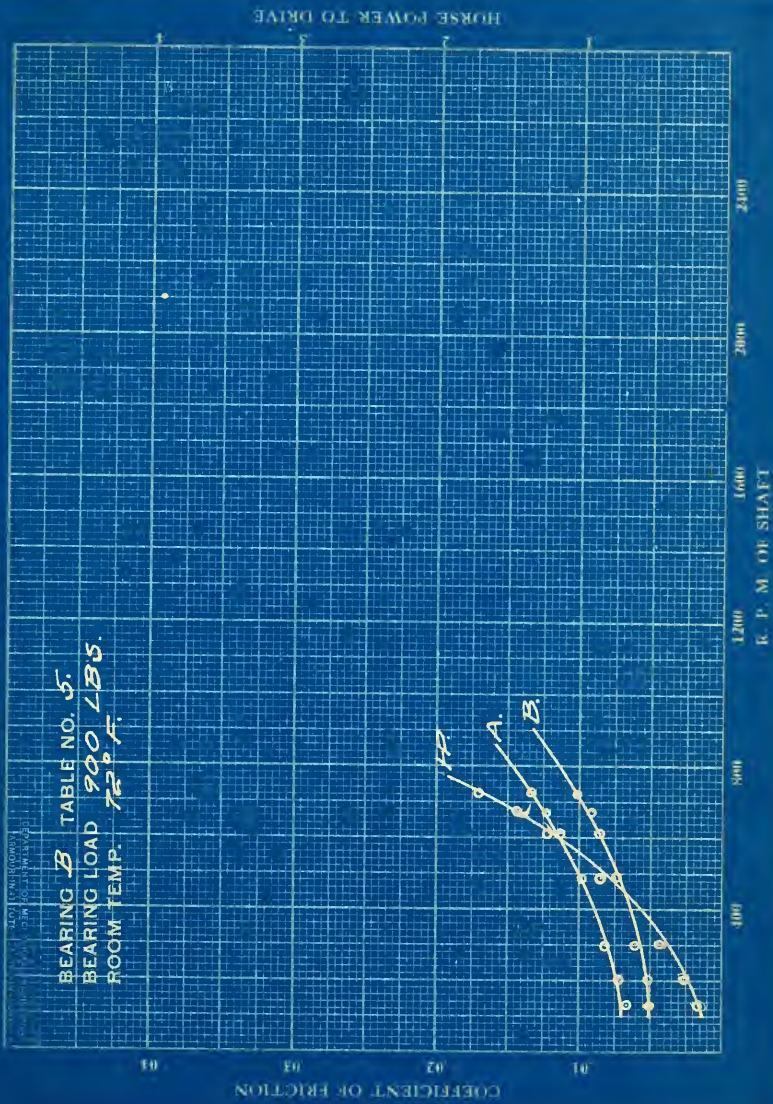
BEARING B TABLE NO. 7.
 BEARING LOAD 1050 LBS.
 ROOM TEMP. 72° F.

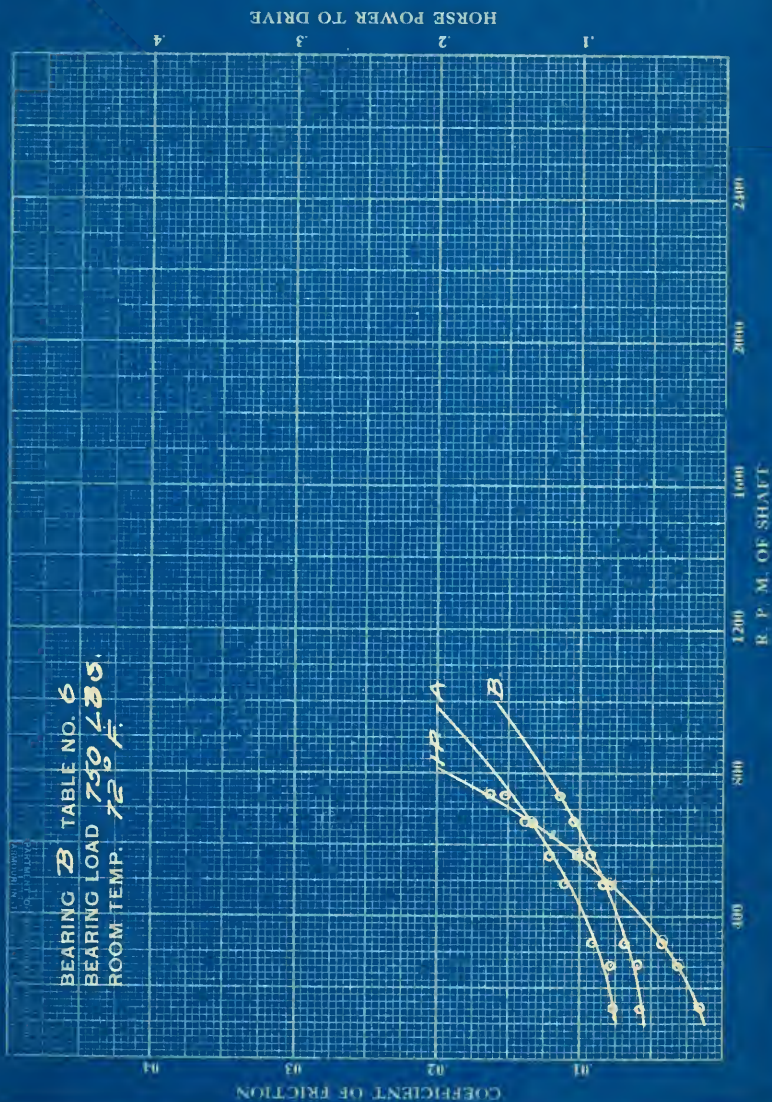
COEFFICIENT OF FRICTION

HORSE POWER TO DRIVE

R. P. M. OF SHAFT

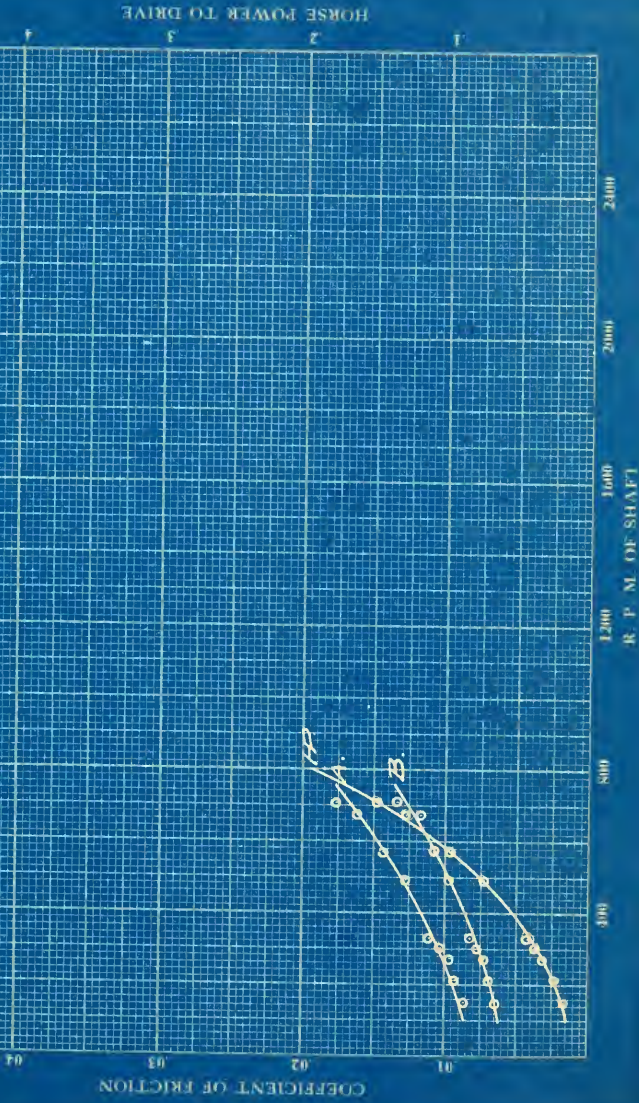


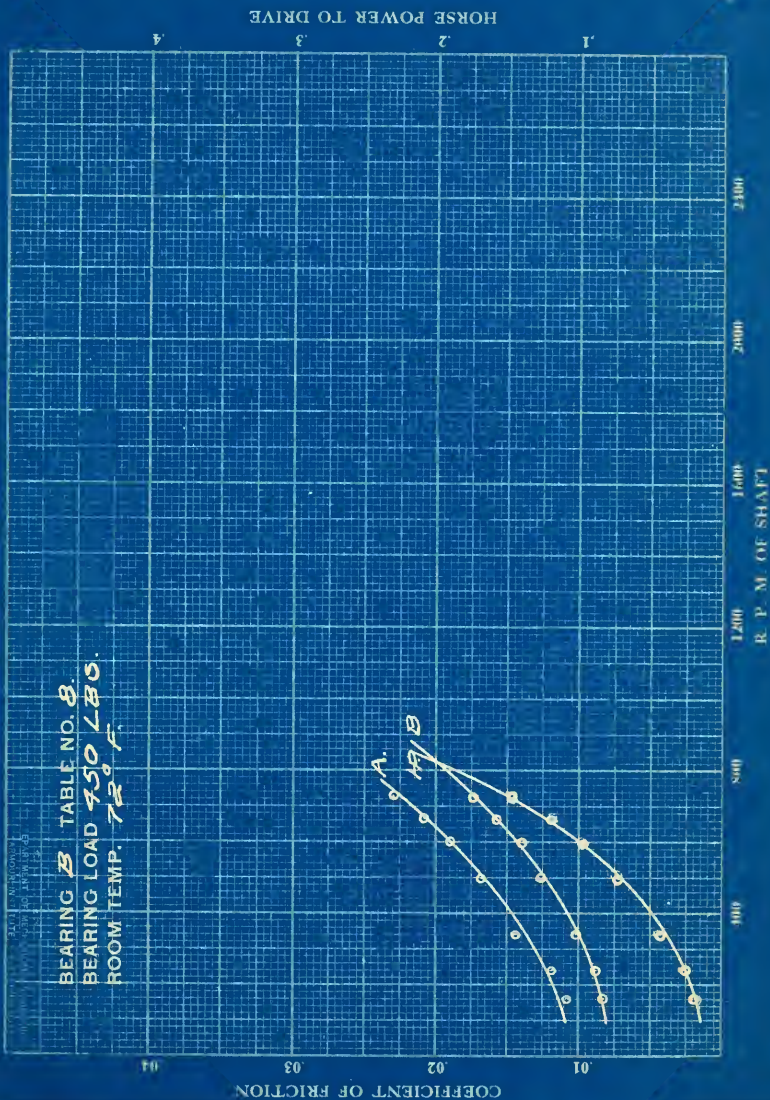




COEFFICIENT OF FRICTION
 AND HORSE POWER TO DRIVE
 THE SHAFTS

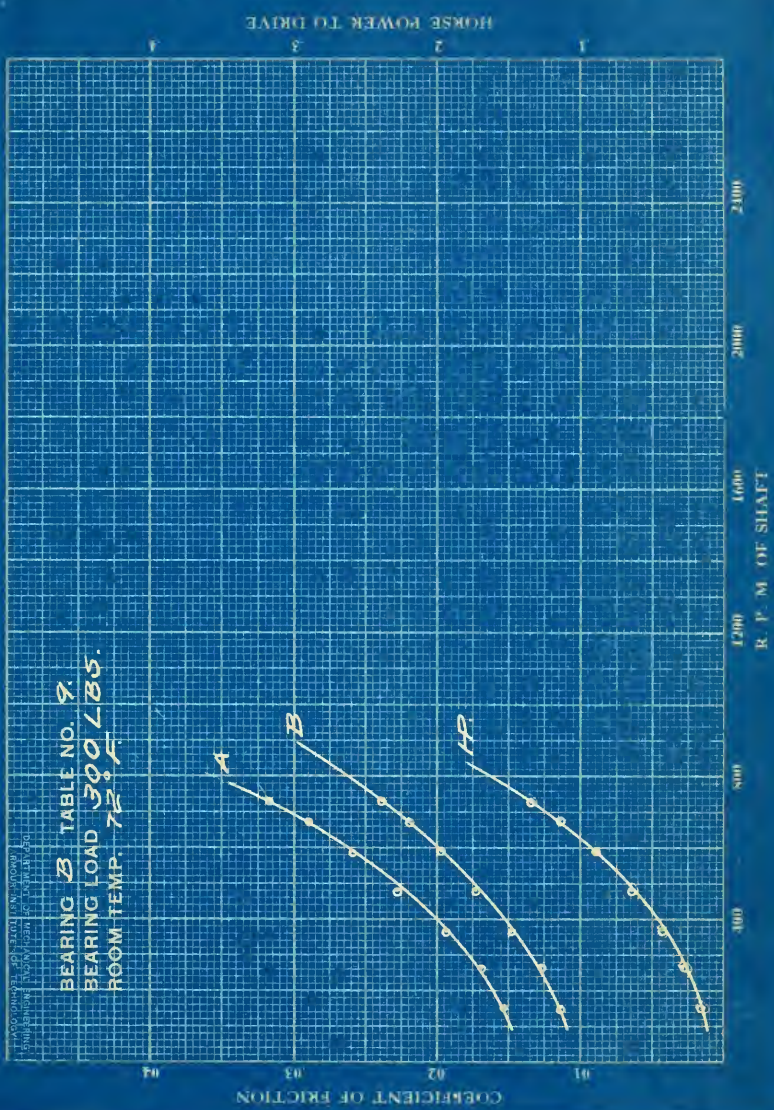
BEARING 3 TABLE NO. 7
 BEARING LOAD 600 LBS
 ROOM TEMP. 72°F





STANDARDIZED FOR MILLING, DRILLING,
AND TURNING OPERATIONS

BEARING *B* TABLE NO. 9.
BEARING LOAD 300 LBS.
ROOM TEMP. 72° F.



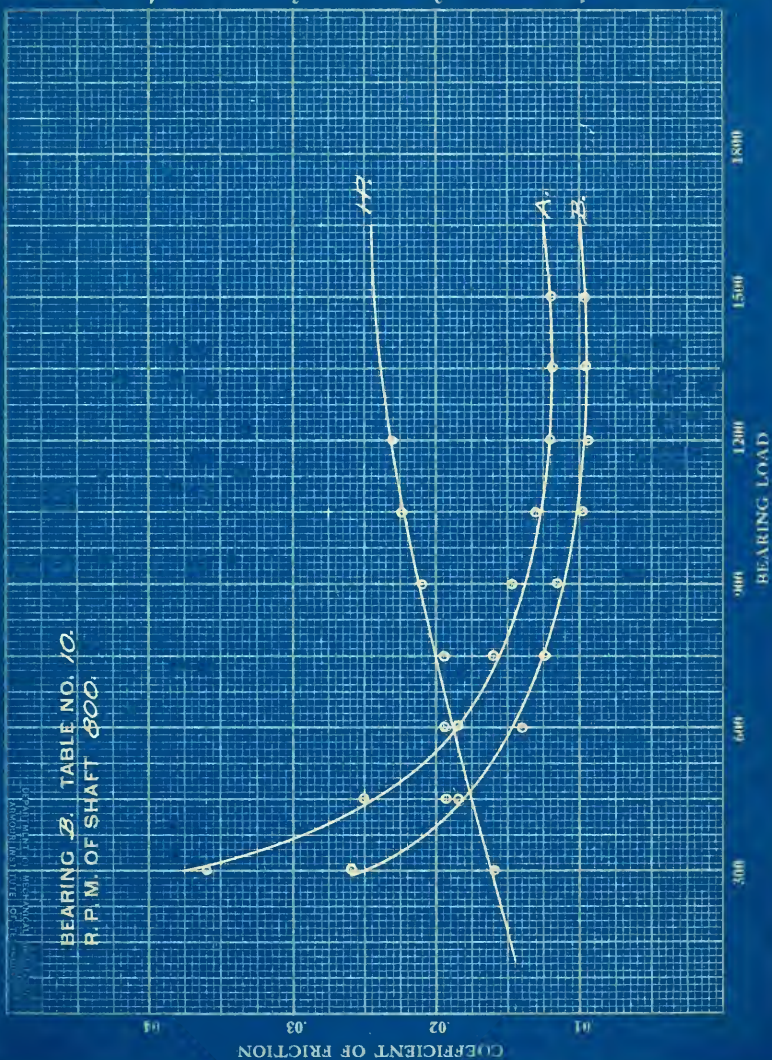
HORSE POWER TO DRIVE

COEFFICIENT OF FRICTION

R. P. M. OF SHAFT

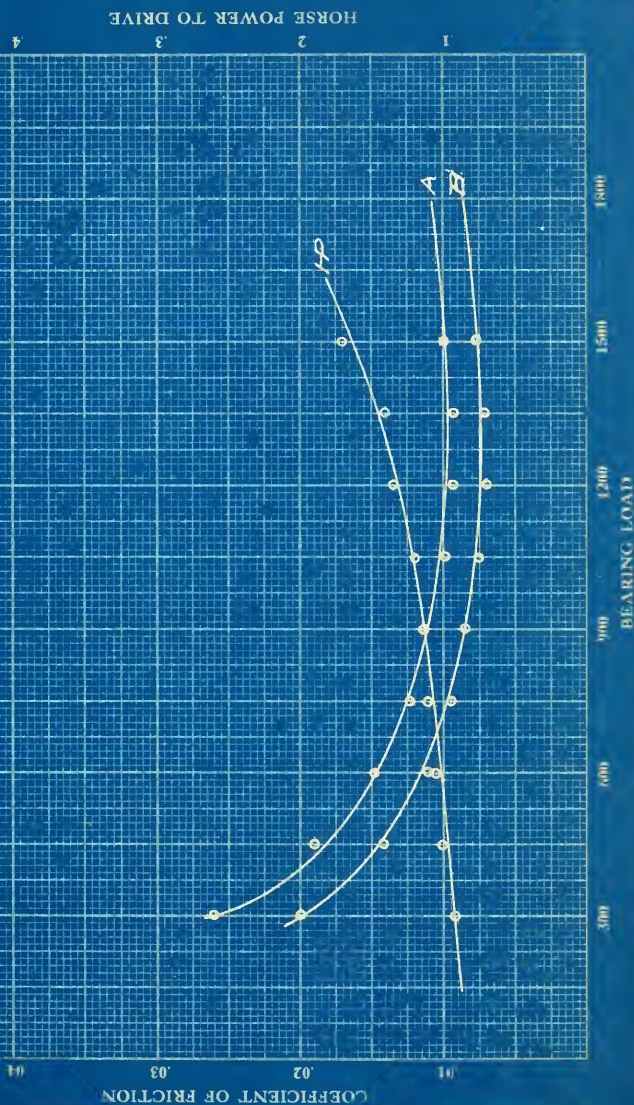
HORSE POWER TO DRIVE

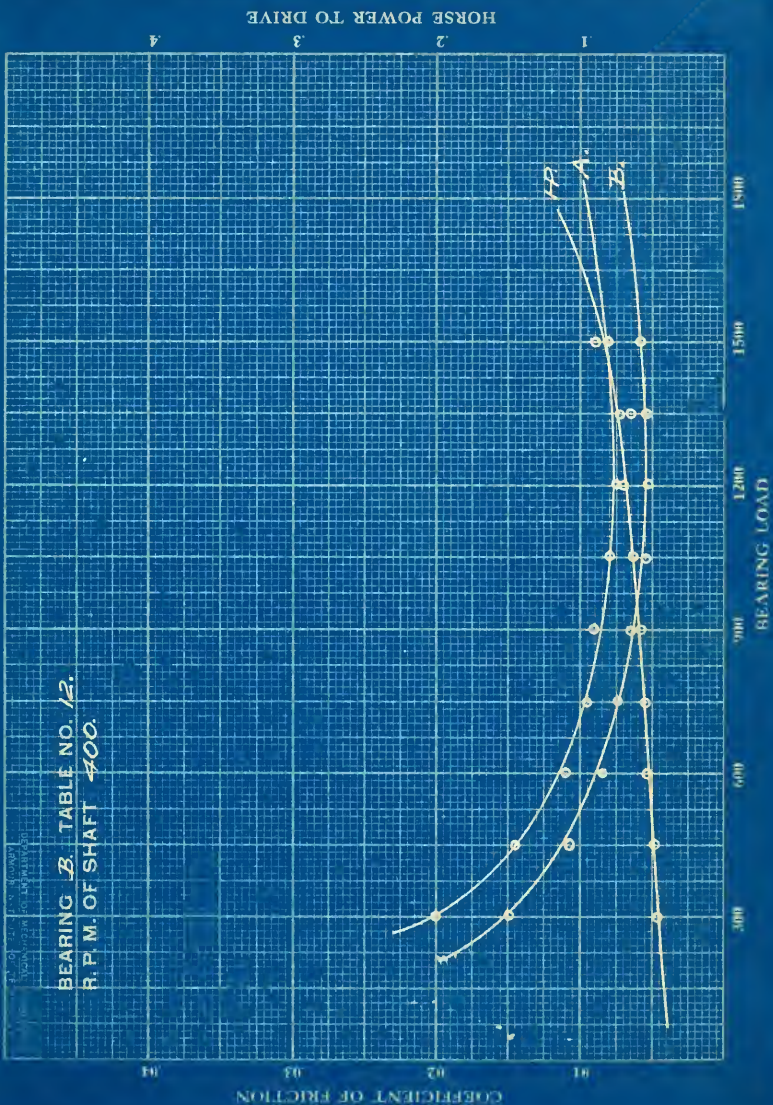
BEARING *B*, TABLE NO. 10.
R. P. M. OF SHAFT 800.

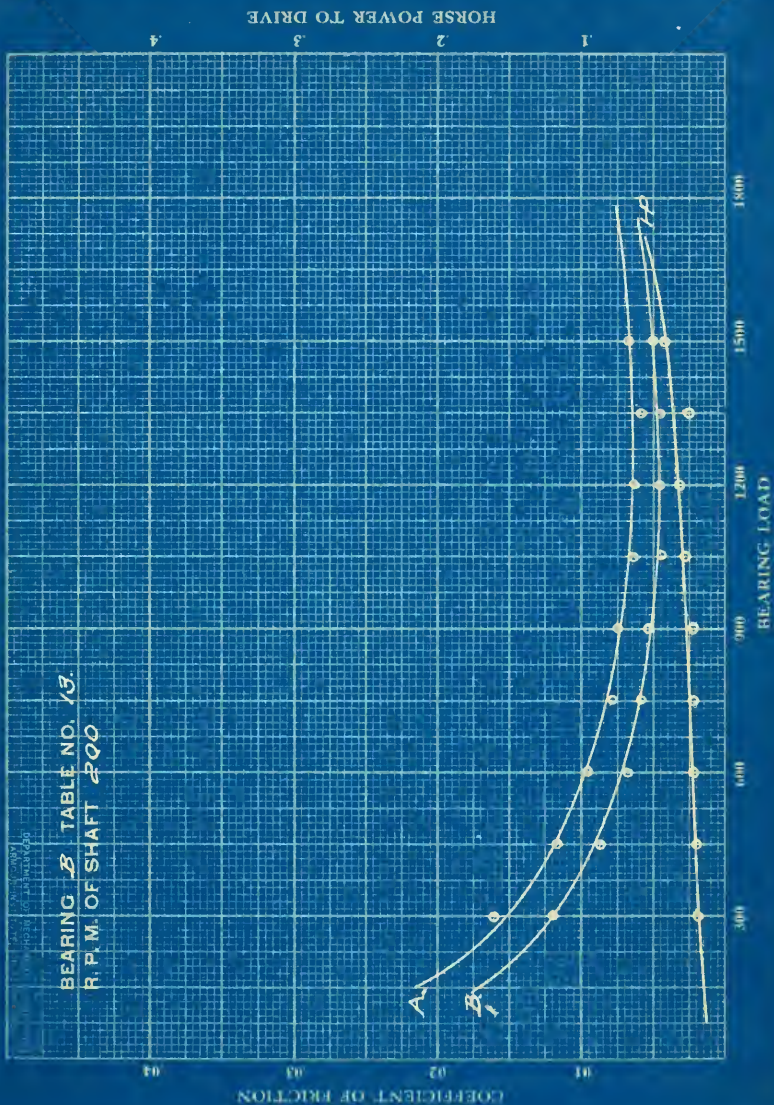


— CO. CHART 22, 40" ELOD (S.W. BROWN)
— AND FILING (W.C. CHAMBERLAIN)

BEARING *B* TABLE NO. 11
R.P.M. OF SHAFT 600.










"BEARING "C"



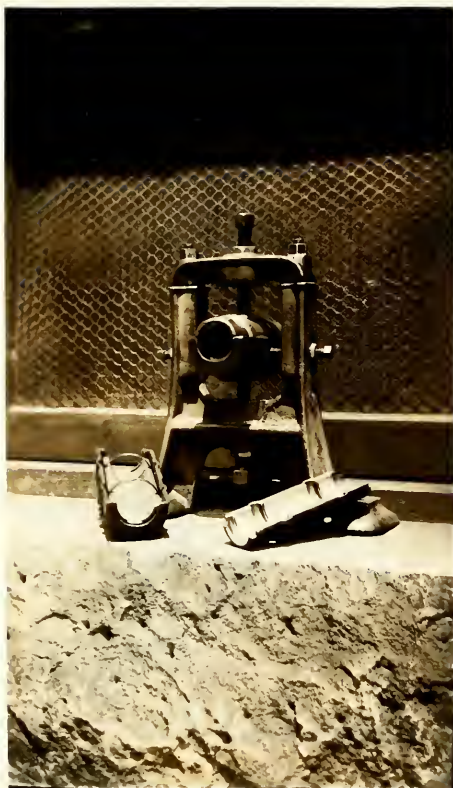


Fig. 9

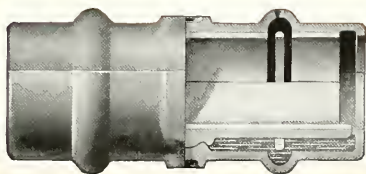


Fig. 10

BEARING "C"

Bearing "C", (Figures 9,10), is the ordinary type of ring oiled babbitt bearing. The housing contains the oil which is carried up from the reservoir to the top of the shaft from whence it is distributed along the whole bearing length. The bottom piece of babbitt is detachable and fits into the lower housing, while the top babbitt is fixed into the upper housing. The babbitt contained no oil grooves.

When this type of bearing is new, it is very economical and its coefficient of friction is low. The reason for this being that the babbitt has high spots on which the shaft runs and because the shaft runs on the high spots, the oil is pressed into the low spots at enormous pressures, thereby, giving the shaft a pressure feed oil lubrication which of necessity lowered the friction in the bearings. After the completion of the tests

on this type of bearing it was found that the bearings had only been worn on two or three high spots.

The fact that in time the high spots on the bearing will wear down so that the shaft will run on the entire babbitt surface does not mean that the friction will be less. To the contrary, the more bearing surface the shaft has, the less oil space it has and the higher the friction will be. In journal bearings, the better the lubrication, the lower the friction.

At no time during the test were we able to start the line shaft with any load on. The bearings were all as loosely adjusted as it was possible to make them, but, even so, the 20 H.P. dynamometer would not turn over the shaft when the load was on. This is certainly a very objectionable feature of this bearing. It shows that the starting or slow moving sliding friction is a long way out of proportion to that of rolling friction.

THE FIRST OF THESE IS THE FACT THAT
THE SECOND IS THE FACT THAT
THE THIRD IS THE FACT THAT

THE FOURTH IS THE FACT THAT
THE FIFTH IS THE FACT THAT
THE SIXTH IS THE FACT THAT

THE SEVENTH IS THE FACT THAT
THE EIGHTH IS THE FACT THAT
THE NINTH IS THE FACT THAT

THE TENTH IS THE FACT THAT
THE ELEVENTH IS THE FACT THAT
THE TWELFTH IS THE FACT THAT

THE THIRTEENTH IS THE FACT THAT
THE FOURTEENTH IS THE FACT THAT
THE FIFTEENTH IS THE FACT THAT

THE SIXTEENTH IS THE FACT THAT
THE SEVENTEENTH IS THE FACT THAT
THE EIGHTEENTH IS THE FACT THAT

THE NINETEENTH IS THE FACT THAT
THE TWENTIETH IS THE FACT THAT
THE TWENTY-FIRST IS THE FACT THAT

THE TWENTY-SECOND IS THE FACT THAT
THE TWENTY-THIRD IS THE FACT THAT
THE TWENTY-FOURTH IS THE FACT THAT

TABLES 1 - 16

OF

BEARING "C"

B E A R I N G C

Table No. 1 Date July 9th, 1915.
 Bearing Load, LBS. 1500 Time, beginning of run 8:50 A.M.
 Room Temp.° Fahr. 69 Time, end of run 9:20 A.M.
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.63	1474	19.85	0.465	0.0109		
0.555	1392	17.48	0.387	0.0096		
0.495	1187	15.58	0.294	0.0085		
0.46	979	14.48	0.225	0.0079		
0.445	888	14.02	0.198	0.0077		
0.425	845	13.38	0.180	0.0073		
0.43	807	12.75	0.164	0.0070		
0.385	750	12.11	0.144	0.0066		
0.375	688	11.80	0.129	0.0065		
0.365	598	11.50	0.109	0.0063		
0.335	497	10.55	0.083	0.0058		
0.34	382	10.70	0.065	0.0059		
0.34	317	10.70	0.053	0.0059		
0.345	302	10.85	0.052	0.0060		

Remarks:—

Table 1

Table 1 shows the results of the regression analysis for the dependent variable Y against the independent variables $X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}$. The results are presented in the following table.

Variable	Parameter	Estimate	Standard Error	t-Statistic	p-Value
X_1	β_1	0.1234	0.0567	2.17	0.0345
X_2	β_2	0.2345	0.0678	3.45	0.0012
X_3	β_3	0.3456	0.0789	4.37	0.0001
X_4	β_4	0.4567	0.0890	5.13	0.0000
X_5	β_5	0.5678	0.0901	6.30	0.0000
X_6	β_6	0.6789	0.1012	6.70	0.0000
X_7	β_7	0.7890	0.1123	7.02	0.0000
X_8	β_8	0.8901	0.1234	7.21	0.0000
X_9	β_9	0.9012	0.1345	6.70	0.0000
X_{10}	β_{10}	0.9123	0.1456	6.27	0.0000

B E A R I N G C

Table No. 2 Date July 9th, 1915.
 Bearing Load, LBS. 1350 Time, beginning of run 9:20 A.M.
 Room Temp.° Fahr. 69 Time, end of run 9:42 A.M.
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.485	1508	15.28	0.366	0.0093		
0.44	1369	13.82	0.301	0.0084		
0.385	1043	12.11	0.201	0.0074		
0.365	914	11.47	0.167	0.0070		
0.355	845	11.17	0.150	0.0068		
0.34	763	10.30	0.126	0.0063		
0.32	688	10.07	0.110	0.0061		
0.305	538	9.61	0.082	0.0058		
0.30	382	9.45	0.057	0.0057		
0.30	290	9.45	0.044	0.0057		
0.315	262	9.93	0.041	0.0060		
0.32	240	10.07	0.038	0.0061		

Remarks:—

Table 1

Summary of the data for the first part of the study. The table shows the results of the experiments for the first part of the study. The data is presented in a table with 5 columns: Experiment, Condition, Mean, SD, and t-value. The experiments are numbered 1 through 10. The conditions are labeled as 'Control' and 'Treatment'. The mean values are shown in the third column, the standard deviation (SD) in the fourth column, and the t-value in the fifth column.

Experiment	Condition	Mean	SD	t-value
1	Control	10.5	2.1	1.2
1	Treatment	11.2	2.3	1.5
2	Control	12.1	2.5	1.8
2	Treatment	13.0	2.7	2.1
3	Control	14.3	2.8	2.4
3	Treatment	15.1	3.0	2.7
4	Control	16.2	3.1	3.0
4	Treatment	17.0	3.3	3.3
5	Control	18.5	3.4	3.6
5	Treatment	19.3	3.6	3.9
6	Control	20.1	3.7	4.2
6	Treatment	21.0	3.9	4.5
7	Control	22.3	4.0	4.8
7	Treatment	23.1	4.2	5.1
8	Control	24.5	4.3	5.4
8	Treatment	25.3	4.5	5.7
9	Control	26.7	4.6	6.0
9	Treatment	27.5	4.8	6.3
10	Control	28.9	4.9	6.6
10	Treatment	29.7	5.1	6.9

B E A R I N G C

Table No. 3 Date July 9th, 1915.
 Bearing Load, LBS. 1200 Time, beginning of run 9:42 A.M.
 Room Temp.° Fahr. 69 Time, end of run 9:58 A.M.
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.465	1620	13.08	0.337	0.0090	
0.37	1386	11.64	0.257	0.0080	
0.32	1060	10.08	0.169	0.0069	
0.295	920	9.28	0.136	0.0064	
0.28	833	8.82	0.117	0.0061	
0.27	773	8.50	0.104	0.0058	
0.255	653	8.04	0.083	0.0055	
0.245	530	7.72	0.065	0.0053	
0.225	328	7.08	0.037	0.0049	
0.24	242	7.56	0.029	0.0052	

Remarks:—

TABLE 1

Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction. The experiments were carried out at 25°C. The concentration of the reactants was varied in the following manner: 1. The concentration of the reactant A was varied while the concentration of the reactant B was kept constant. 2. The concentration of the reactant B was varied while the concentration of the reactant A was kept constant. 3. The concentration of both reactants A and B was varied in the same proportion.

Experiment No.	Concentration of A (M)	Concentration of B (M)	Initial Rate (M/s)	Final Rate (M/s)
1	0.1	0.1	0.01	0.01
2	0.2	0.1	0.02	0.02
3	0.3	0.1	0.03	0.03
4	0.4	0.1	0.04	0.04
5	0.5	0.1	0.05	0.05
6	0.1	0.2	0.02	0.02
7	0.1	0.3	0.03	0.03
8	0.1	0.4	0.04	0.04
9	0.1	0.5	0.05	0.05
10	0.2	0.2	0.04	0.04
11	0.3	0.3	0.09	0.09
12	0.4	0.4	0.16	0.16
13	0.5	0.5	0.25	0.25

B E A R I N G C

Table No. 4 Date July 9th, 1915.

Bearing Load, LBS. 1050 Time, beginning of run 9:58 A.M.

Room Temp.° Fahr. 69 Time, end of run 10:15 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.39	1659	12.28	0.324	0.0096	
0.335	1498	10.56	0.251	0.0083	
0.29	1273	9.13	0.185	0.0071	
0.24	934	7.56	0.112	0.0059	
0.23	819	7.25	0.094	0.0057	
0.225	753	7.08	0.085	0.0055	
0.21	607	6.62	0.064	0.0052	
0.195	415	6.14	0.040	0.0048	
0.195	267	6.14	0.026	0.0048	
0.185	223	5.83	0.021	0.0046	

Remarks:—

TABLE 1

Summary of the results of the analysis of variance for the effect of the concentration of the solution on the rate of the reaction.

Concentration of the solution	Rate of the reaction	Concentration of the solution	Rate of the reaction
0.01 M	0.01	0.01 M	0.01
0.02 M	0.02	0.02 M	0.02
0.03 M	0.03	0.03 M	0.03
0.04 M	0.04	0.04 M	0.04
0.05 M	0.05	0.05 M	0.05
0.06 M	0.06	0.06 M	0.06
0.07 M	0.07	0.07 M	0.07
0.08 M	0.08	0.08 M	0.08
0.09 M	0.09	0.09 M	0.09
0.10 M	0.10	0.10 M	0.10

B E A R I N G C

Table No. 5 Date July 9th, 1915.
 Bearing Load, LBS. 900 Time, beginning of run 10:15 A.M.
 Room Temp.° Fahr. 69 Time, end of run 10:30 A.M.
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.365	1618	11.50	0.295	0.0105		
0.32	1448	10.08	0.231	0.0092		
0.28	1258	8.82	0.176	0.0081		
0.245	1118	7.73	0.137	0.0072		
0.215	933	6.78	0.100	0.0062		
0.205	863	6.46	0.088	0.0059		
0.20	796	6.30	0.080	0.0058		
0.195	728	6.46	0.075	0.0059		
0.200	561	6.30	0.056	0.0058		
0.195	481	6.14	0.047	0.0056		
0.185	373	5.83	0.035	0.0053		
0.17	276	5.36	0.024	0.0049		
0.175	240	5.52	0.021	0.0050		

Remarks:—

TABLE 1

Summary of the results of the experiments conducted during the period from January 1, 1950, to December 31, 1951, on the effect of the application of various concentrations of the chemical substance, "X", on the growth and yield of the crop "Y". The results are presented in the following table, showing the mean values for the different treatments and the standard error of the mean.

Treatment	Concentration of "X"	Mean Yield (kg/ha)	Standard Error (kg/ha)
Control	0	12.5	0.5
T1	0.1	13.2	0.4
T2	0.2	14.1	0.3
T3	0.3	15.0	0.2
T4	0.4	15.8	0.1
T5	0.5	16.5	0.1
T6	0.6	17.2	0.1
T7	0.7	17.9	0.1
T8	0.8	18.6	0.1
T9	0.9	19.3	0.1
T10	1.0	20.0	0.1

B E A R I N G C

Table No. 6 Date July 9th, 1915.
 Bearing Load, LBS. 750 Time, beginning of run 10:35 A.M.
 Room Temp.° Fahr. 69 Time, end of run 10:50 A.M.
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.355	1608	11.18	0.286	0.0122		
0.315	1472	9.92	0.232	0.0109		
0.285	1274	8.98	0.182	0.0098		
0.23	1073	7.25	0.123	0.0080		
0.215	958	6.78	0.103	0.0074		
0.20	885	6.30	0.089	0.0069		
0.19	807	5.98	0.077	0.0066		
0.185	724	5.83	0.067	0.0064		
0.175	548	5.51	0.048	0.0060		
0.165	424	5.20	0.035	0.0057		
0.155	343	4.88	0.027	0.0054		
0.155	300	4.88	0.023	0.0054		
0.15	230	4.72	0.017	0.0052		

Remarks:—

Table 1

Table 1 shows the results of the experiment. The first column lists the different conditions tested. The second column shows the mean value of the response, and the third column shows the standard deviation. The fourth column shows the number of subjects who participated in the experiment. The fifth column shows the number of trials that were completed. The sixth column shows the number of trials that were rejected. The seventh column shows the number of trials that were not completed. The eighth column shows the number of trials that were not rejected. The ninth column shows the number of trials that were not completed. The tenth column shows the number of trials that were not rejected.

Condition	Mean	SD	N	Completed	Rejected	Not Completed	Not Rejected	Not Completed	Not Rejected
Control	1.2	0.5	10	8	2	2	8	2	8
Condition 1	1.5	0.6	10	7	3	3	7	3	7
Condition 2	1.8	0.7	10	6	4	4	6	4	6
Condition 3	2.1	0.8	10	5	5	5	5	5	5
Condition 4	2.4	0.9	10	4	6	6	4	6	4
Condition 5	2.7	1.0	10	3	7	7	3	7	3
Condition 6	3.0	1.1	10	2	8	8	2	8	2
Condition 7	3.3	1.2	10	1	9	9	1	9	1
Condition 8	3.6	1.3	10	0	10	10	0	10	0
Condition 9	3.9	1.4	10	0	10	10	0	10	0
Condition 10	4.2	1.5	10	0	10	10	0	10	0

B E A R I N G C

Table No. 7 Date July 9th, 1915.
 Bearing Load, LBS. 700 Time, beginning of run 10:50 A.M.
 Room Temp.° Fahr. 69 Time, end of run 11:05 A.M.
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.325	1664	10.21	0.271	0.0140		
0.29	1500	9.13	0.218	0.0125		
0.25	1323	7.88	0.166	0.0108		
0.22	1122	6.93	0.123	0.0095		
0.19	944	5.98	0.090	0.0082		
0.17	816	5.35	0.069	0.0073		
0.145	621	4.56	0.045	0.0063		
0.125	373	3.94	0.023	0.0054		
0.115	264	3.62	0.015	0.0050		
0.11	203	3.46	0.011	0.0047		

Remarks:—

B E A R I N G C

Table No. 8 Date July 9th, 1915.

Bearing Load, LBS. 450 Time, beginning of run 11:05 A.M.

Room Temp.° Fahr. 69 Time, end of run 11:21 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.29	1660	9.13		0.241	0.0167	
0.27	1583	8.50		0.214	0.0155	
0.245	1463	7.72		0.179	0.0141	
0.225	1224	7.08		0.137	0.0129	
0.405	1177	6.46		0.121	0.0118	
0.175	967	5.51		0.085	0.0101	
0.155	860	4.88		0.067	0.0089	
0.145	760	4.57		0.055	0.0084	
0.12	525	3.78		0.032	0.0069	
0.12	411	3.78		0.025	0.0069	
0.10	230	3.15		0.012	0.0058	
0.08	168	2.52		0.007	0.0046	

Remarks:—

B E A R I N G C

Table No. 9 Date July 9th, 1915.
 Bearing Load, LBS. 300 Time, beginning of run 11:21 A.M.
 Room Temp.° Fahr. 69 Time, end of run 11:38 A.M.
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.25	1660	7.88		0.208	0.0216	
0.235	1611	7.40		0.189	0.0203	
0.22	1503	6.93		0.165	0.0190	
0.205	1248	6.46		0.128	0.0177	
0.17	1137	5.36		0.097	0.0147	
0.145	979	4.57		0.071	0.0125	
0.135	888	4.25		0.060	0.0117	
0.13	818	4.09		0.053	0.0112	
0.115	660	3.62		0.038	0.0099	
0.105	535	3.31		0.028	0.0091	
0.095	396	2.99		0.019	0.0082	
0.075	236	2.36		0.009	0.0065	
0.07	180	2.21		0.006	0.0061	

Remarks:—

• 1988

• • •

DATA INTERPOLATED
FROM TABLES 1—9

Bearing C

R. P. M. of Shaft 1600

Table No. 10

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500		0.012	
1350	0.415	0.01	
1200	0.336	0.0088	
1050	0.29	0.0092	
900	0.29	0.0105	
750	0.285	0.0125	
600	0.245	0.0135	
450	0.225	0.016	
300	0.25	0.0195	

Remarks:—

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ C _____

R. P. M. of Shaft _____ 1200 _____

Table No. _____ 11 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.32	0.0092	
1350	0.26	0.008	
1200	0.21	0.0075	
1050	0.182	0.007	
900	0.162	0.0076	
750	0.16	0.009	
600	0.142	0.0098	
450	0.128	0.0126	
300	0.115	0.017	

Remarks:—



DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ C _____

R. P. M. of Shaft _____ 1000 _____

Table No. _____ 12 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.23	0.008	
1350	0.195	0.007	
1200	0.155	0.007	
1050	0.137	0.006	
900	0.12	0.0066	
750	0.12	0.0077	
600	0.10	0.0084	
450	0.11	0.009	
300	0.135	0.008	

Remarks:—

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ C _____

R. P. M. of Shaft _____ 800 _____

Table No. 13 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.16	0.007	
1350	0.14	0.0065	
1200	0.11	0.0063	
1050	0.10	0.0065	
900	0.077	0.0066	
750	0.076	0.0065	
600	0.071	0.0067	
450	0.095	0.006	
300	0.105	0.0053	

Remarks:—

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ C _____

R. P. M. of Shaft _____ 600 _____

Table No. 14 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.105	0.006	
1350	0.1	0.0061	
1200	0.075	0.0057	
1050	0.065	0.0051	
900	0.047	0.0052	
750	0.047	0.006	
600	0.04	0.0061	
450	0.035	0.0078	
300	0.03	0.0085	

Remarks:—

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ C _____

R. P. M. of Shaft _____ 400 _____

Table No. **15** _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.068	0.006	
1350	0.065	0.006	
1200	0.047	0.0053	
1050	0.04	0.005	
900	0.027	0.0049	
750	0.027	0.0055	
600	0.020	0.0055	
450	0.017	0.006	
300	0.013	0.0065	

Remarks:—



DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ C _____

R. P. M. of Shaft _____ 200 _____

Table No. **16** _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.041	0.006	
1350	0.038	0.0064	
1200	0.028	0.205	
1050	0.022	0.0051	
900	0.020	0.005	
750	0.020	0.0053	
600	0.010	0.005	
450	0.008	0.0045	
300	0.005	0.0056	

Remarks:—

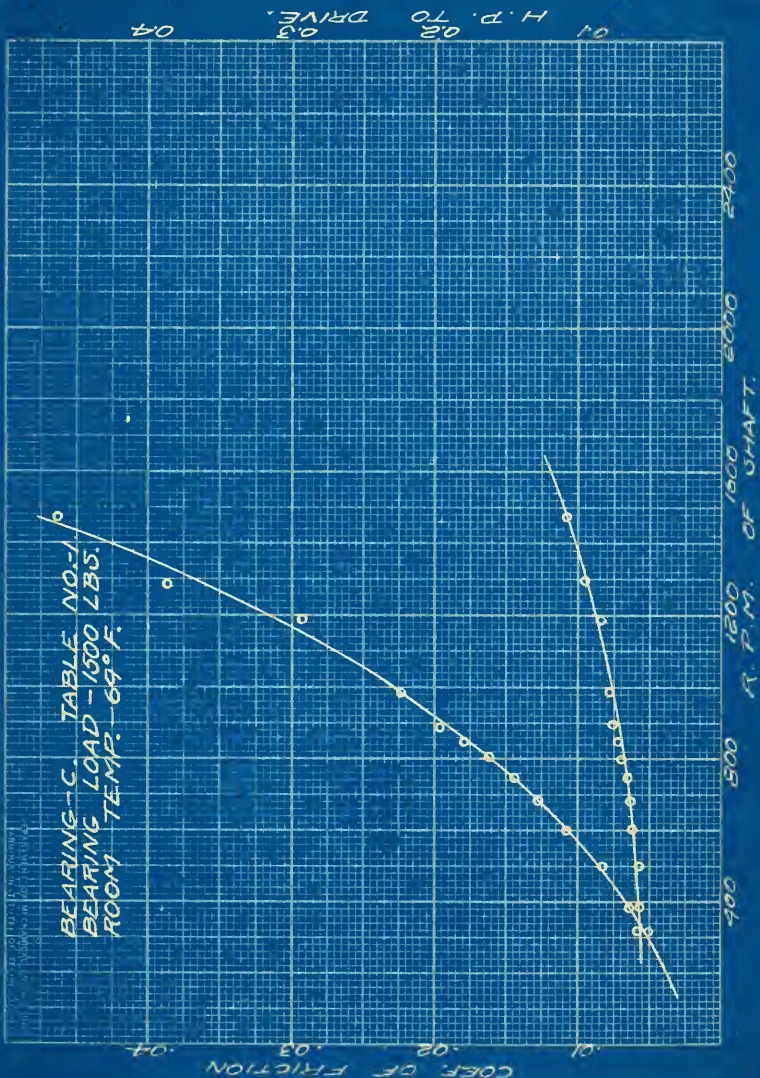
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TABLES 1 - 16
OF
BEARING "C"

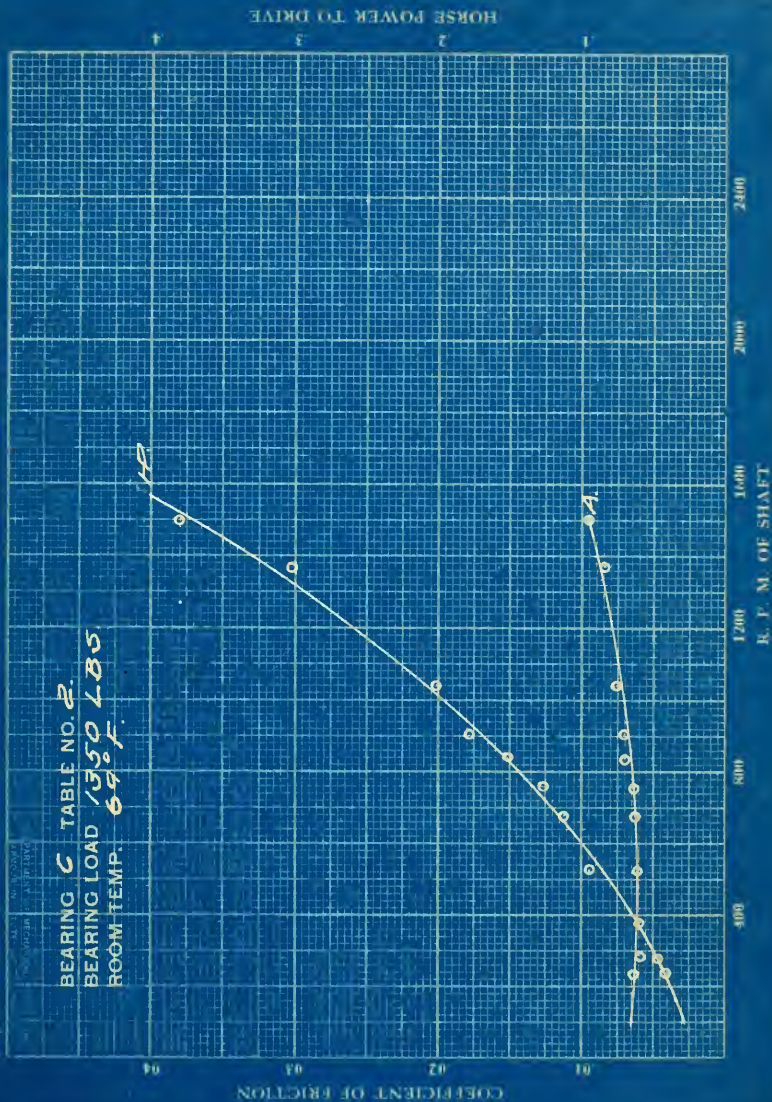
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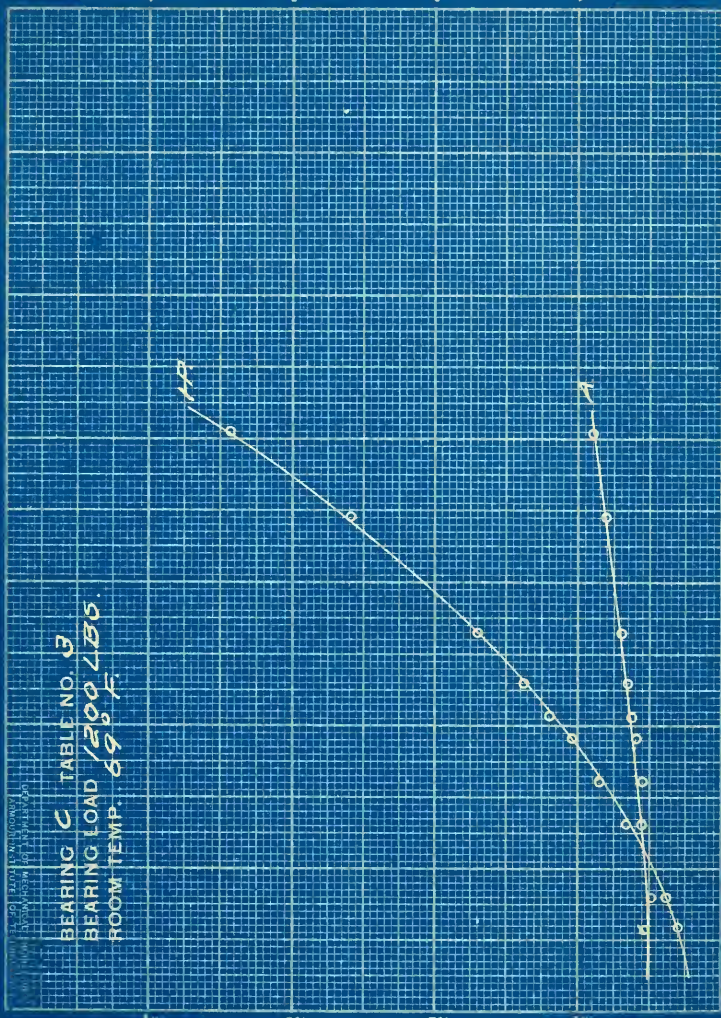


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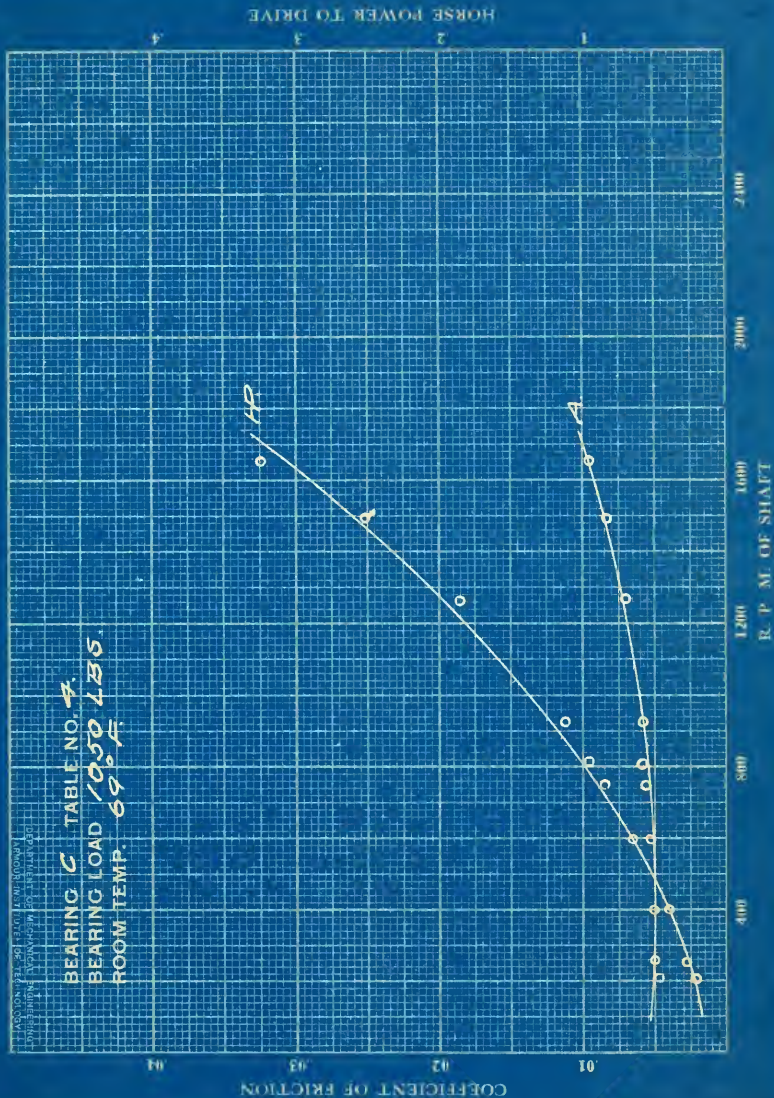
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 BEARING LOAD 1300 LBS.
 ROOM TEMP. 69° F.

COEFFICIENT OF FRICTION

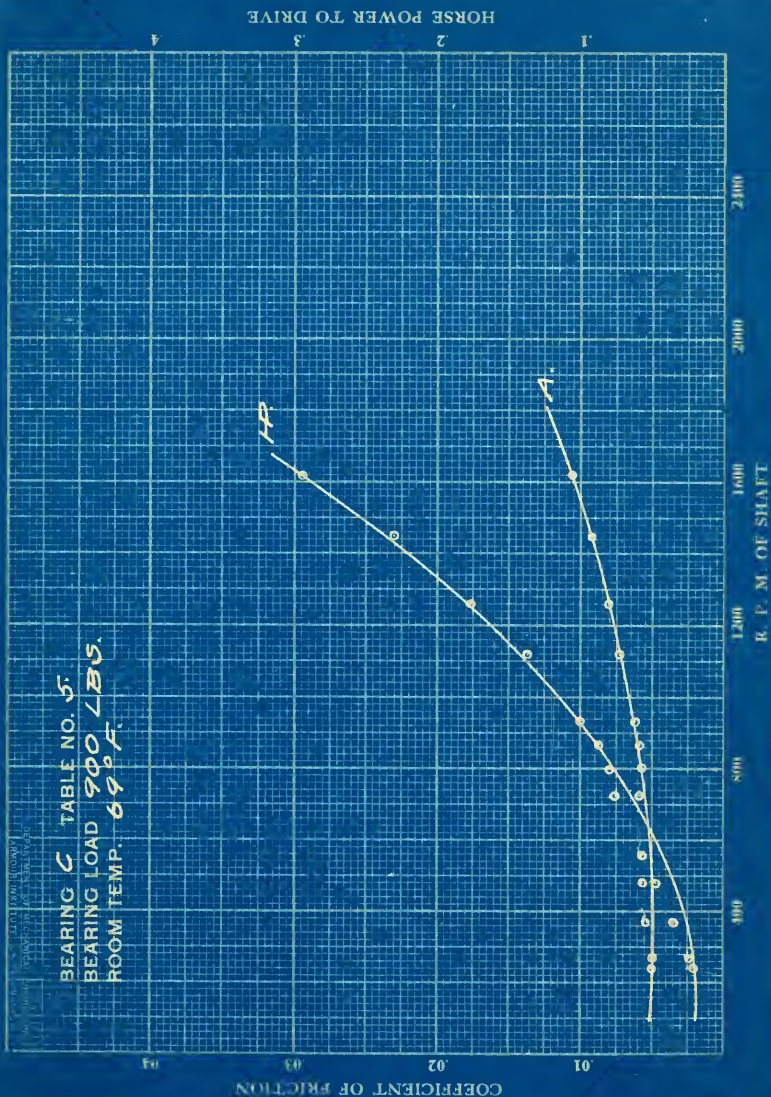
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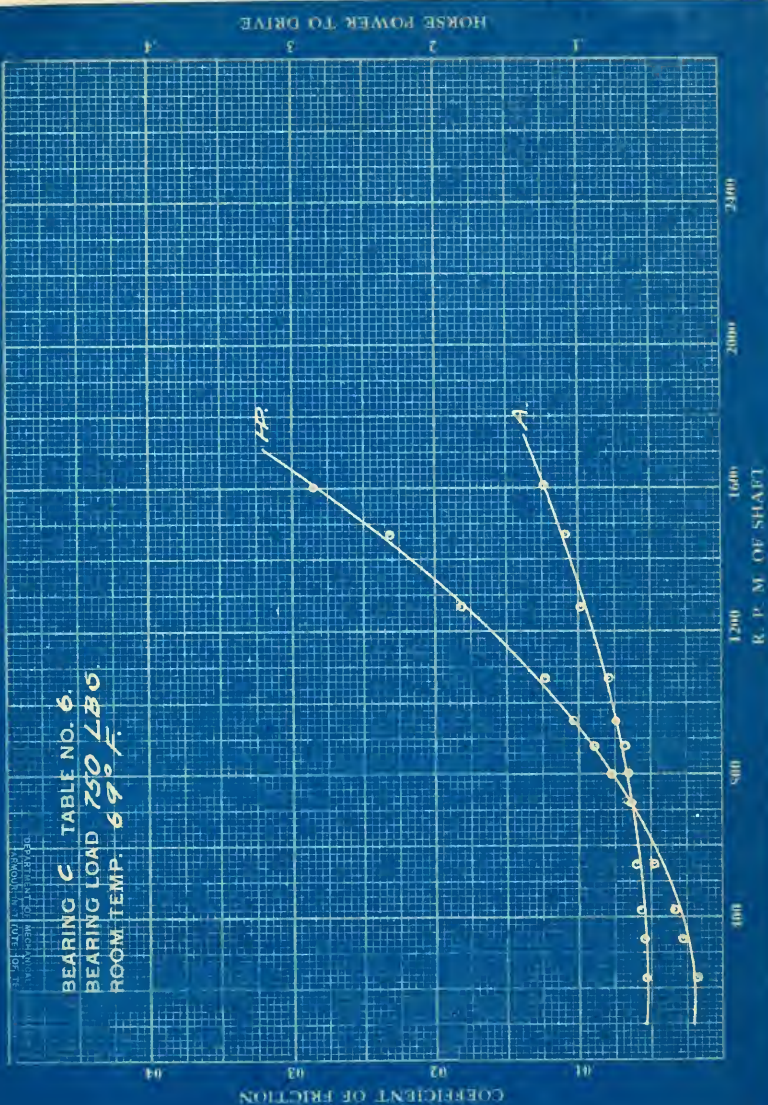


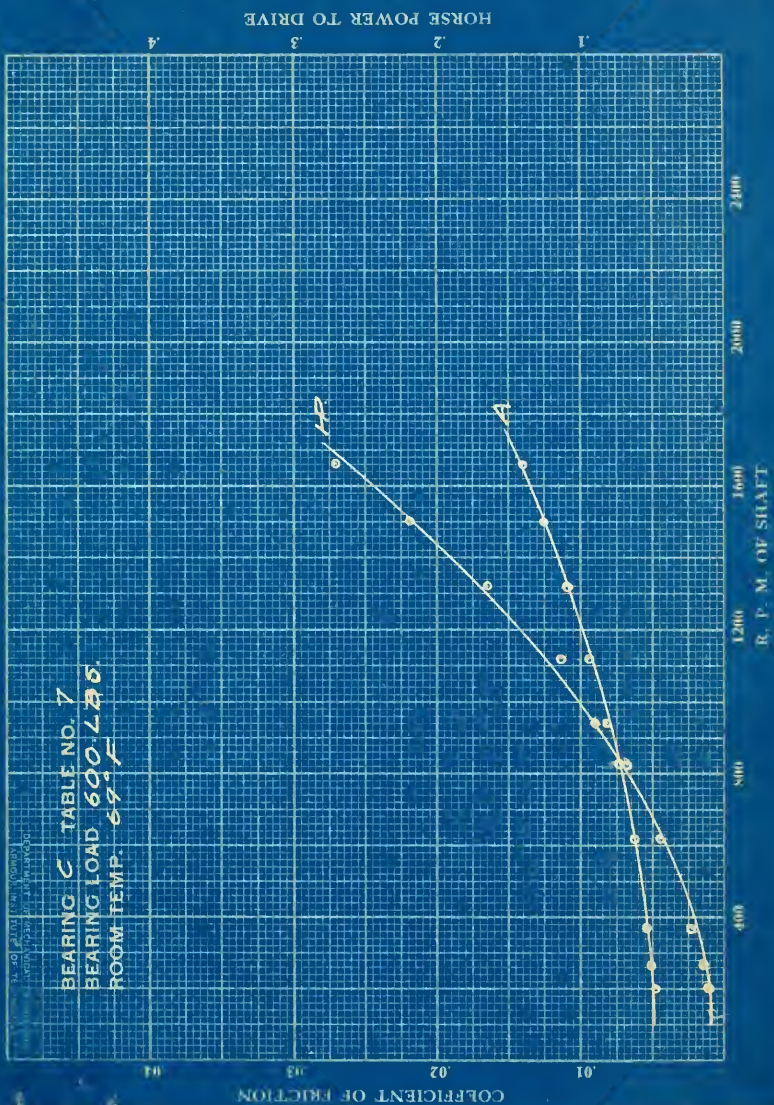
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BEARING LOAD 1050 LBS
ROOM TEMP. 69°F.

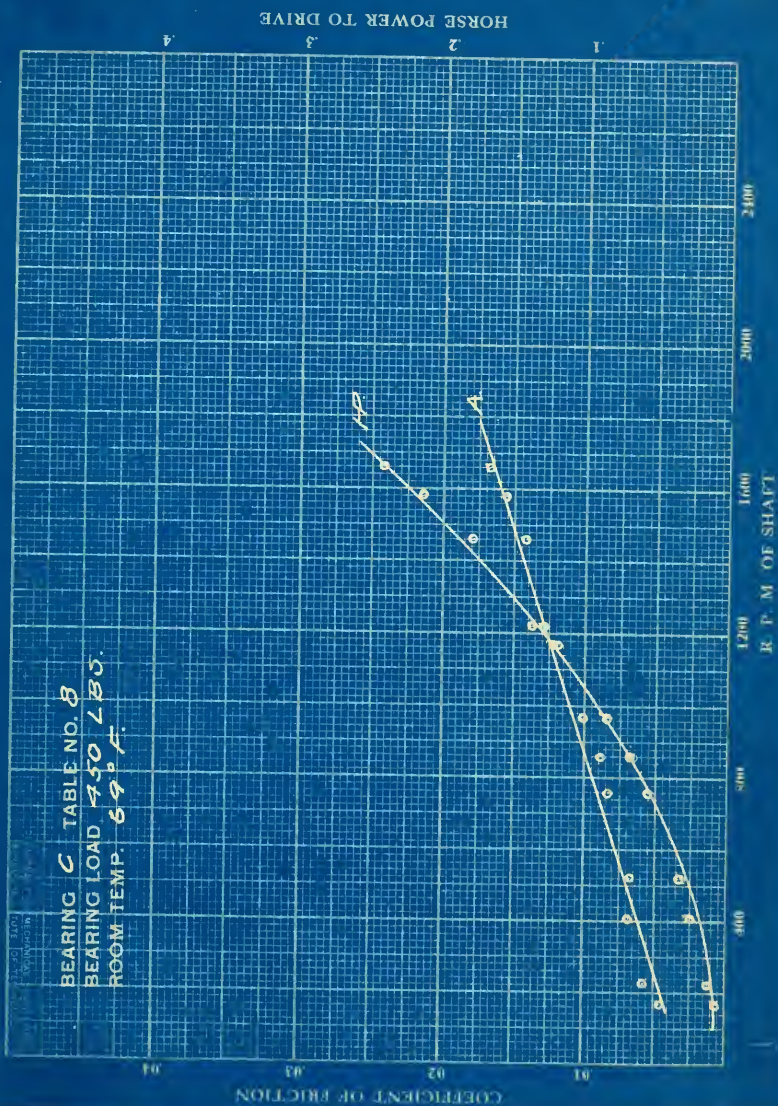


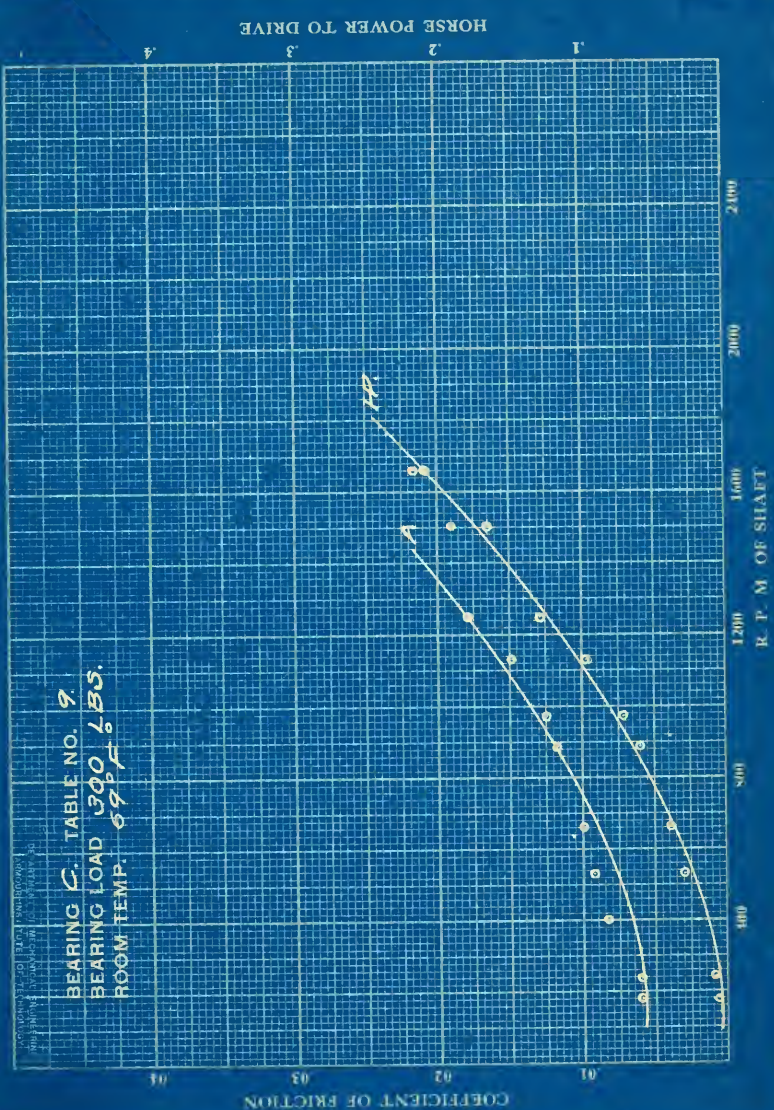


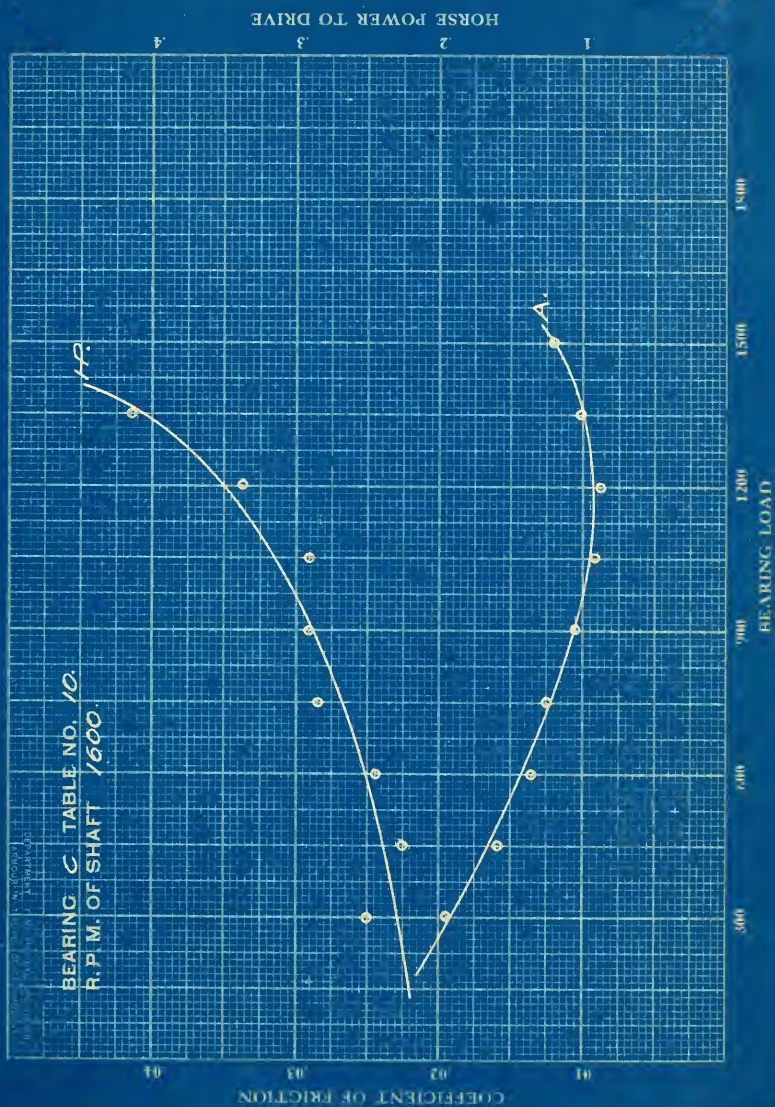


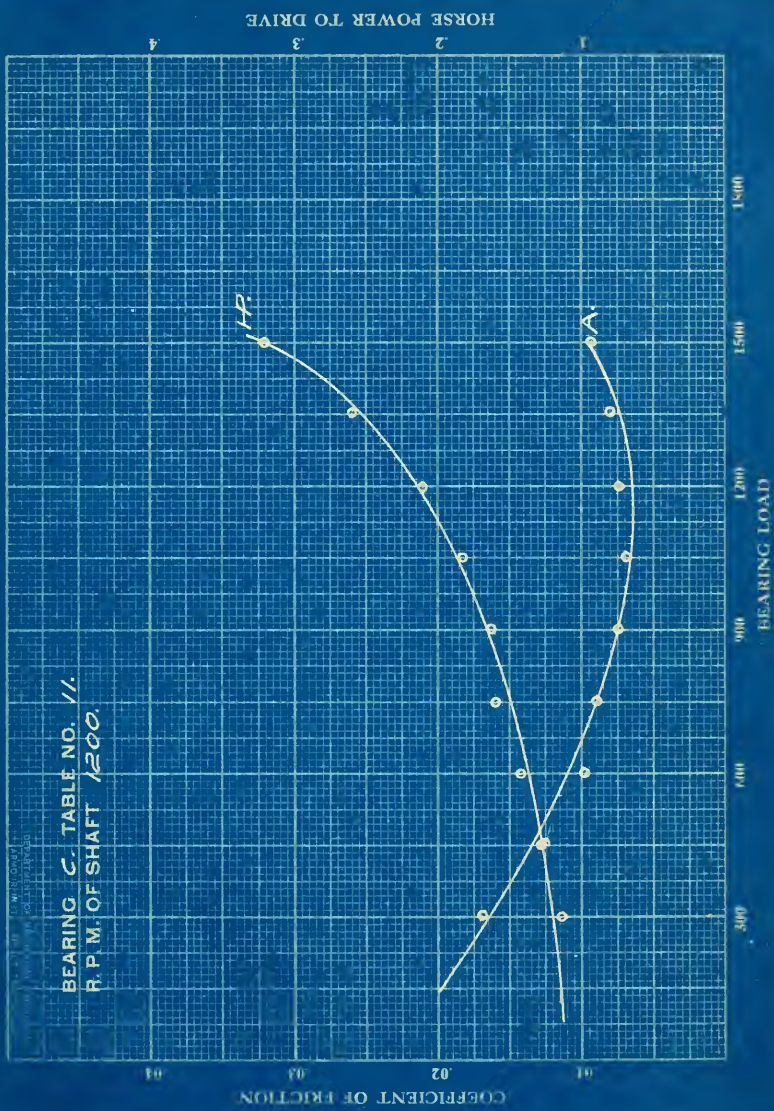


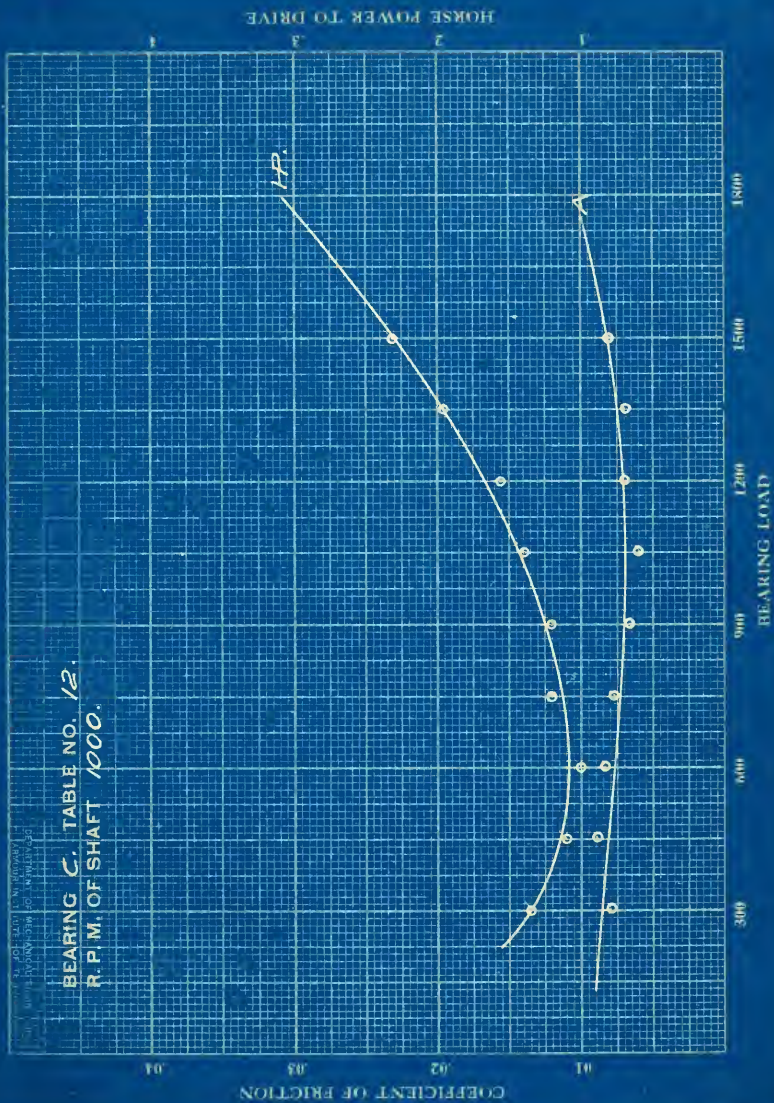






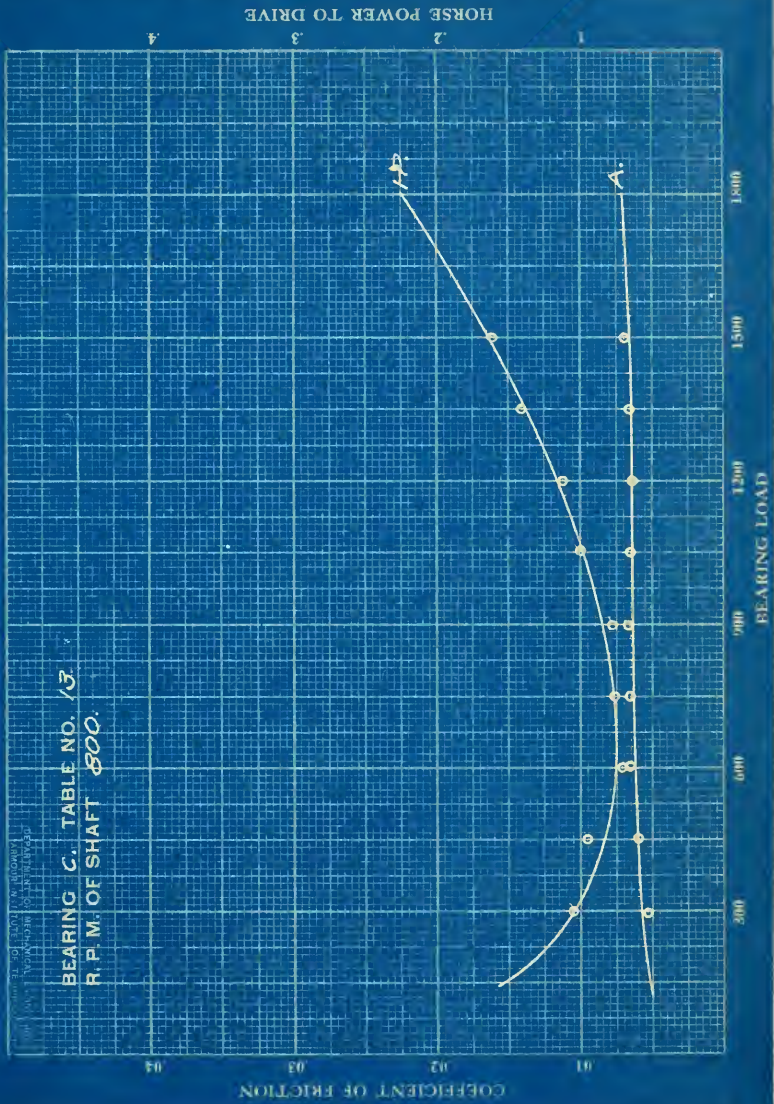


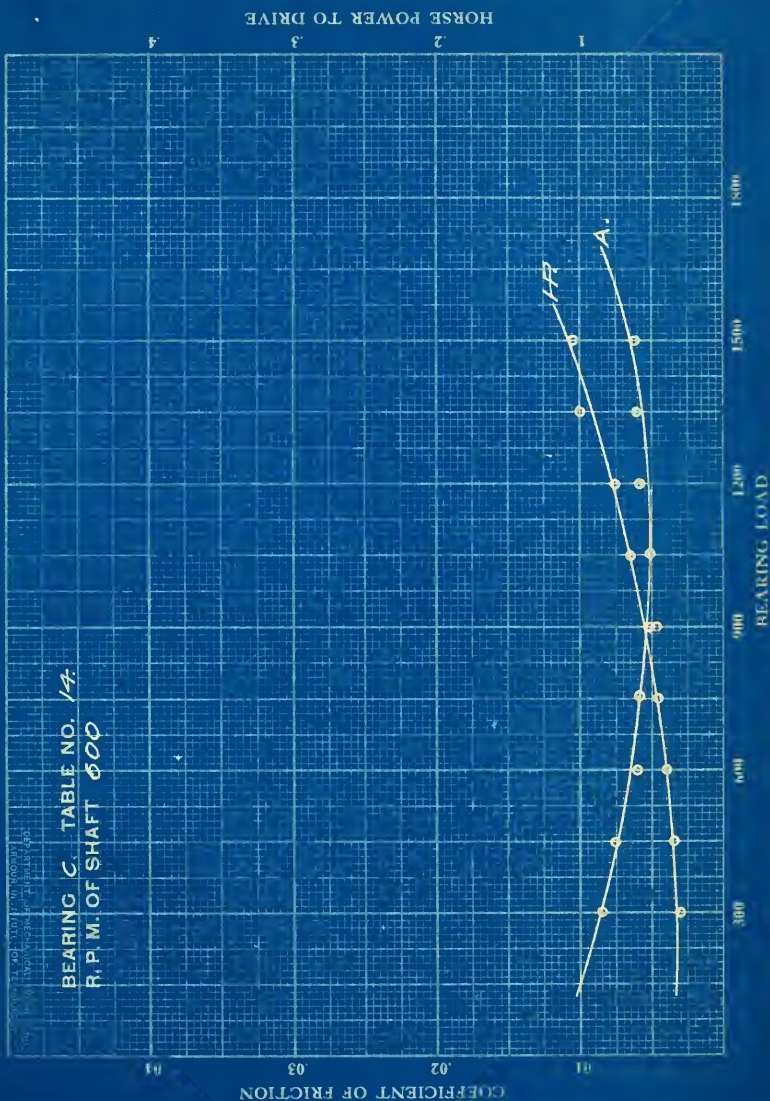




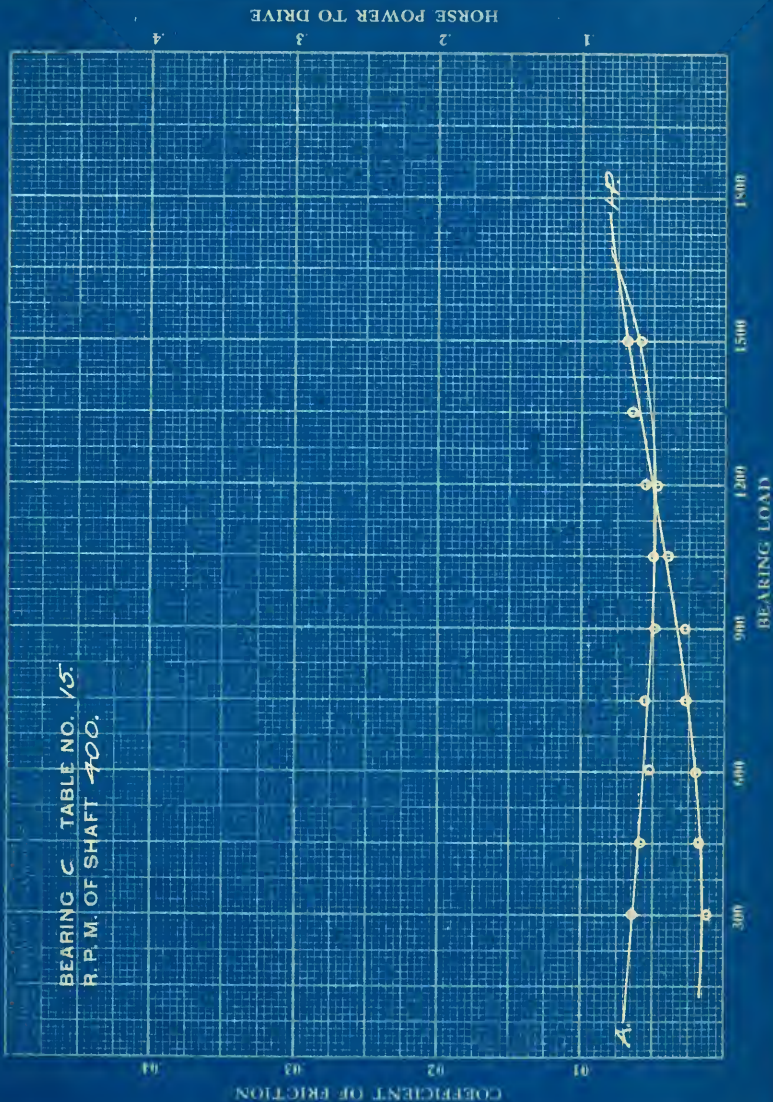
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 FROM THE JOURNAL OF MECHANICAL ENGINEERING

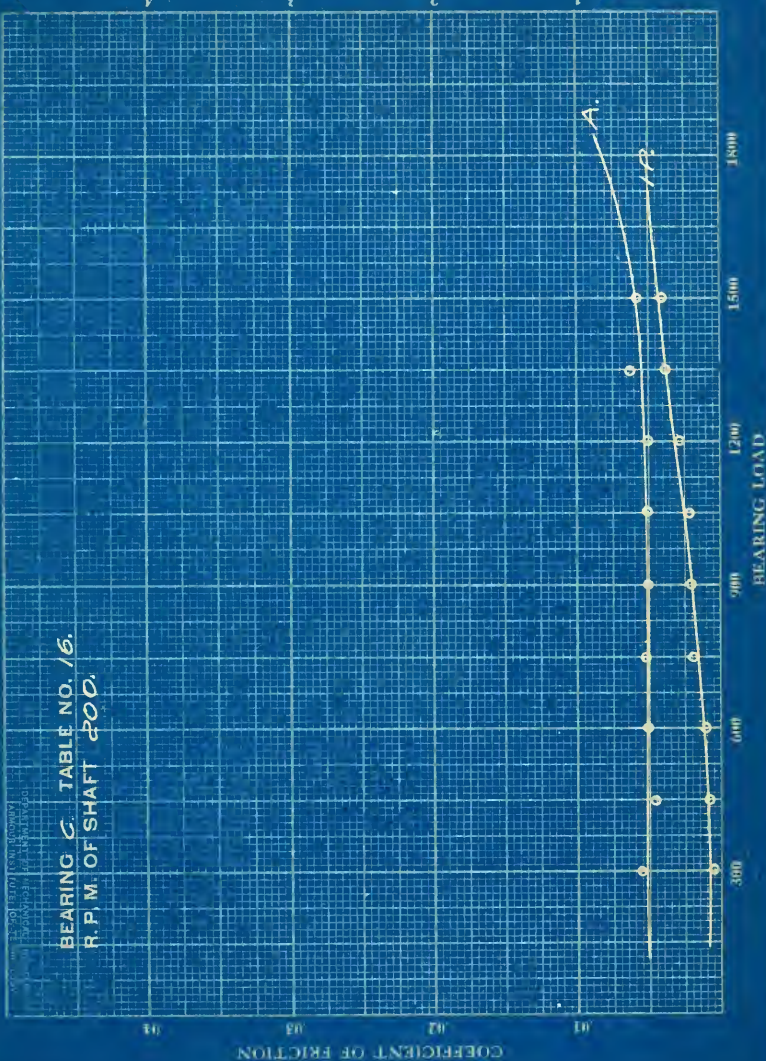
BEARING C., TABLE NO. 13
 R. P. M. OF SHAFT 800.





BEARING C TABLE NO. 15.
R. P. M. OF SHAFT 400.







BEARING "D"



Fig. 11

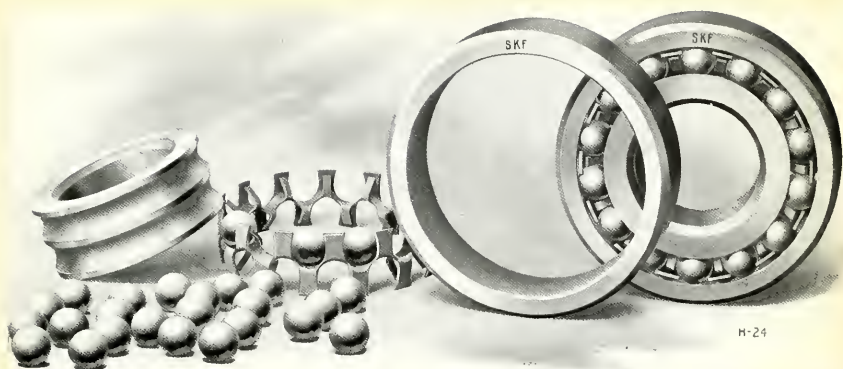


Fig. 12

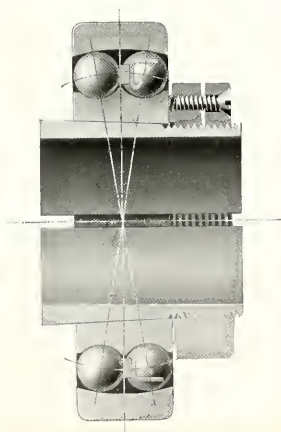


Fig. 13

BEARING "D"

Bearing "D", (Figures 11,12,13), is a self aligning adapter type radial ball bearing. The bearing consists of an outer ball race, an inner ball race, two rows of balls, a retainer for properly spacing and retaining the balls between the raceways and a housing for the whole.

The inner race contains two grooves, each ground to a radius slightly larger than the radius of the balls, while the outer race is ground in the form of a hollow sphere, whose center is the center of the axis of rotation. The balls, the retainer and inner race are free to rotate at any angle within the outer race and will adjust themselves to any possible degree of deflection of the shaft without binding either the balls or raceways.

The balls roll on the surface of the spherically ground outer ball race with a pure rolling motion without sliding friction.

This action is facilitated by the distribution of the load over a large number of balls.

These bearings were found to be highly efficient both in coefficient of friction and horse power to drive, and the reasons for this are plentiful. The friction in a ball bearing is independent of the viscosity of the lubricant or its temperature; the frictional resistance of starting and slow motion is very low. Another advantage it has is that it is more compact.

This type of bearing permits of the use of more balls per bearing, because, the two rows of balls are held in staggered relation by the retainer. This increases the carrying capacity of the bearing. The retainer is made of one piece and it is open at the sides permitting easy cleaning and positive lubrication.

The bearings were found to run absolutely cool at any load and speed and very economical, but, upon taking the bearings apart after the

This motion is identical to the motion
of the first case. It is a
translation.

These two motions are identical to the
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test, it was seen that the ball races had become slightly grooved because of the load. This immediately decreases the efficiency of the bearing, because, there then is an area of contact instead of a point contact.

and you have the same old story
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and you have the same old story

TABLES 1 - 16
of
BEARING "D"

AT - 1000000
To
1000000

B E A R I N G D

Table No. 1 Date July 14th, 1915.

Bearing Load, LBS. 1500 Time, beginning of run 9:25 A.M.

Room Temp.° Fahr. 74 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.145	2023	4.57	0.147	0.00249	0.00148
0.125	1832	3.94	0.114	0.00215	0.00129
0.11	1546	3.46	0.085	0.00189	0.00113
0.105	1354	3.31	0.071	0.00181	0.00108
0.09	1114	2.84	0.050	0.00155	0.00092
0.085	872	2.67	0.037	0.00146	0.00087
0.085	817	2.67	0.035	0.00146	0.00087
0.08	636	2.52	0.025	0.00138	0.00082
0.07	496	2.20	0.017	0.00121	0.00072
0.065	284	2.05	0.0092	0.00112	0.00067
0.06	130	1.89	0.0039	0.00103	0.00061

Remarks:—

TABLE I

Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction between the acid and the base.

Concentration of the acid (M)	Concentration of the base (M)	Rate of reaction (sec)	Rate of reaction (min)
0.1	0.1	100	1.67
0.2	0.2	50	0.83
0.3	0.3	33	0.56
0.4	0.4	25	0.42
0.5	0.5	20	0.33
0.6	0.6	17	0.28
0.7	0.7	14	0.23
0.8	0.8	12	0.20
0.9	0.9	11	0.18
1.0	1.0	10	0.17

B E A R I N G D

Table No. 2 Date July 14th, 1915.

Bearing Load, LBS. 1350 Time, beginning of run _____

Room Temp. ° Fahr. 74 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.115	2120	3.62		0.122	0.00221	0.00132
0.10	2003	3.15		0.100	0.00192	0.00114
0.09	1784	2.84		0.080	0.00173	0.00103
0.085	1570	2.67		0.0667	0.00163	0.00097
0.085	1218	2.67		0.0517	0.00163	0.00097
0.085	1115	2.67		0.0473	0.00163	0.00097
0.08	057	2.52		0.0382	0.00154	0.00083
0.075	857	2.36		0.0321	0.00144	0.00086
0.07	730	2.20		0.0255	0.00134	0.00080
0.065	591	2.05		0.0192	0.00125	0.00075
0.06	431	1.88		0.0129	0.00115	0.00069
0.055	316	1.73		0.0087	0.00105	0.00063
0.05	205	1.57		0.0051	0.00096	0.00057

Remarks:— Collar friction eased up at beginning
of run.

TABLE I

1950

1. The following table shows the number of persons employed in the various occupations in the United States in 1950, by sex and race.

2. The following table shows the number of persons employed in the various occupations in the United States in 1950, by sex and race.

Occupation	Male	Female	Total
1. Agriculture, forestry, and fishing	1,200,000	100,000	1,300,000
2. Manufacturing and construction	1,500,000	500,000	2,000,000
3. Transportation and communication	800,000	200,000	1,000,000
4. Wholesale and retail trade	1,000,000	800,000	1,800,000
5. Services	1,200,000	1,000,000	2,200,000
6. Government	1,000,000	500,000	1,500,000
7. Unemployed	1,000,000	500,000	1,500,000
8. Not in labor force	1,000,000	1,000,000	2,000,000
9. Total	10,000,000	8,000,000	18,000,000

Source: Bureau of Economic Analysis, Department of Commerce, "National Income and Product Accounts for the United States, 1950."

Continued

B E A R I N G D

Table No. 3 Date July 14th, 1915.

Bearing Load, LBS. 1200 Time, beginning of run 10:03 A.M.

Room Temp.° Fahr. 74 Time, end of run 10:21 A.M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.095	2205	2.99		0.1045	0.00205	0.00122
0.085	1963	2.67		0.0835	0.00183	0.00109
0.08	1753	2.52		0.0702	0.00173	0.00103
0.08	1477	2.52		0.0590	0.00173	0.00103
0.075	1380	2.30		0.0518	0.00162	0.00097
0.075	1127	2.39		0.0422	0.00162	0.00097
0.07	975	2.20		0.0342	0.00151	0.00090
0.065	882	2.05		0.0286	0.00141	0.00084
0.06	831	1.89		0.0249	0.00129	0.00077
0.055	659	1.73		0.0181	0.00119	0.00071
0.055	498	1.73		0.0137	0.00119	0.00071
0.05	329	1.57		0.0082	0.00108	0.00064
0.04	125	1.26		0.0025	0.00086	0.00051

Remarks:—

TABLE I

Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction

The reaction was carried out at 25°C. The concentration of the reactants was varied as shown in the table. The rate of the reaction was measured by the method of the initial rates.

Experiment	Conc. of A, M	Conc. of B, M	Conc. of C, M	Initial rate, M/sec	Rate constant, l./mole-sec
1	0.10	0.10	0.10	0.0010	10
2	0.20	0.10	0.10	0.0020	10
3	0.10	0.20	0.10	0.0020	10
4	0.10	0.10	0.20	0.0010	10
5	0.20	0.20	0.10	0.0040	10
6	0.10	0.10	0.40	0.0010	10
7	0.20	0.10	0.40	0.0020	10
8	0.10	0.20	0.40	0.0020	10
9	0.20	0.20	0.40	0.0040	10
10	0.10	0.10	0.10	0.0010	10
11	0.20	0.10	0.10	0.0020	10
12	0.10	0.20	0.10	0.0020	10
13	0.10	0.10	0.20	0.0010	10
14	0.20	0.20	0.20	0.0040	10
15	0.10	0.10	0.10	0.0010	10

B E A R I N G D

Table No. 4 Date July 14th, 1915.

Bearing Load, LBS. 1050 Time, beginning of run 10:21 A.M.

Room Temp.° Fahr. 74 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.095	2260	2.99		0.1073	0.00234	0.00139
0.09	2034	2.83		0.0915	0.00221	0.00131
0.085	1768	2.67		0.0952	0.00209	0.00125
0.075	1572	2.36		0.0590	0.00184	0.00110
0.07	1385	2.20		0.0485	0.00172	0.00102
0.07	1125	2.20		0.0395	0.00172	0.00102
0.07	974	2.20		0.0341	0.00172	0.00102
0.065	869	2.05		0.0282	0.00160	0.00095
0.06	747	1.89		0.0224	0.00148	0.00088
0.055	590	1.73		0.0162	0.00136	0.00081
0.045	342	1.42		0.0077	0.00111	0.00066
0.035	146	1.10		0.0026	0.00086	0.00051

Remarks:—

B E A R I N G D

Table No. 5 Date July 14th, 1915.

Bearing Load, LBS. 900 Time, beginning of run _____

Room Temp.° Fahr. 74 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.09	2272	2.84		0.1022	0.00259	0.00155
0.085	1994	2.67		0.0847	0.00244	0.00146
0.08	1722	2.52		0.0690	0.00230	0.00137
0.07	1505	2.20		0.0537	0.00205	0.00122
0.065	1272	2.05		0.0414	0.00187	0.00111
0.065	1158	2.05		0.0377	0.00187	0.00111
0.065	964	2.05		0.0314	0.00187	0.00111
0.065	902	2.05		0.0292	0.00187	0.00111
0.055	804	1.73		0.0221	0.00158	0.00094
0.045	618	1.42		0.0139	0.00130	0.00078
0.035	328	1.10		0.0058	0.00100	0.00060
0.03	125	0.95		0.0019	0.00087	0.00057

Remarks:—

B E A R I N G D

Table No. 6 Date July 14th, 1915.
 Bearing Load, LBS. 750 Time, beginning of run _____
 Room Temp.° Fahr. 74 Time, end of run 11:04 A.M.
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.085	2307	2.67	0.0981	0.00292	0.00174
0.075	2053	2.36	0.0770	0.00258	0.00154
0.065	1761	2.05	0.0573	0.00224	0.00134
0.06	1601	1.89	0.0483	0.00207	0.00124
0.055	1274	1.73	0.0350	0.00189	0.00113
0.055	1157	1.73	0.0318	0.00189	0.00113
0.055	983	1.73	0.0270	0.00189	0.00113
0.05	876	1.58	0.0219	0.00173	0.00103
0.045	788	1.42	0.0178	0.00156	0.00093
0.04	616	1.26	0.0123	0.00138	0.00082
0.35	445	1.10	0.0078	0.00120	0.00072
0.025	210	0.79	0.0026	0.00087	0.00057

Remarks:—

BEARING D

Table No. 7 Date July 14th, 1915.

Bearing Load, LBS. 600 Time, beginning of run 11:04 A.M.

Room Temp.° Fahr. 74 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.08	2310	2.52	0.0925	0.00345	0.00206
0.07	2012	2.21	0.0705	0.00303	0.00187
0.06	1731	1.89	0.0519	0.00259	0.00155
0.055	1451	1.73	0.0400	0.00237	0.00141
0.05	1255	1.58	0.0314	0.00216	0.00129
0.05	1170	1.58	0.0293	0.00216	0.00129
0.05	1004	1.58	0.0251	0.00216	0.00129
0.045	936	1.42	0.0211	0.00194	0.00116
0.045	822	1.42	0.0185	0.00194	0.00116
0.04	700	1.26	0.0140	0.00172	0.00103
0.03	513	0.95	0.0077	0.00129	0.00077
0.03	350	0.95	0.0053	0.00129	0.00077
0.0225	150	0.71	0.0017	0.00097	0.00058

Remarks:—

TABLE I

Summary of the results of the

experiments on the

effect of the concentration of the solution on the rate of reaction

at 25°C. The concentration of the solution was varied from 0.1 to 1.0 M.

The rate of reaction was measured by the method of initial rates.

The results are given in the following table.

Concentration of solution (M)	Rate of reaction (M/min)
0.1	0.001
0.2	0.002
0.3	0.003
0.4	0.004
0.5	0.005
0.6	0.006
0.7	0.007
0.8	0.008
0.9	0.009
1.0	0.010

TABLE II

B E A R I N G D

Table No. 8 Date July 14th, 1915.

Bearing Load, LBS. 450 Time, beginning of run _____

Room Temp.° Fahr. 74 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.075	2293	2.36	0.0860	0.00432	0.00251
0.065	2034	2.05	0.0661	0.00375	0.00223
0.055	1689	1.73	0.0464	0.00316	0.00188
0.05	1554	1.58	0.0388	0.00289	0.00172
0.05	1403	1.58	0.0351	0.00289	0.00172
0.045	1160	1.42	0.0261	0.00259	0.00154
0.045	986	1.42	0.0222	0.00259	0.00154
0.04	900	1.26	0.0180	0.00230	0.00137
0.04	837	1.26	0.0167	0.00230	0.00137
0.035	704	1.10	0.0123	0.00201	0.00120
0.025	333	0.79	0.0042	0.00141	0.00086
0.02	130	0.63	0.0013	0.00115	0.00069

Remarks:—

TABLE 1

Summary of the results of the analysis of variance for the effect of the concentration of the solution on the rate of reaction. The data are given in Table 2. The rate of reaction was determined by the change in the optical density of the solution at 440 mμ. The concentration of the solution was varied from 0.01 to 0.10 M. The rate of reaction was found to increase with increasing concentration of the solution. The rate of reaction was found to be independent of the concentration of the solution at 0.01 M and 0.02 M. The rate of reaction was found to be independent of the concentration of the solution at 0.05 M and 0.10 M. The rate of reaction was found to be independent of the concentration of the solution at 0.01 M and 0.02 M. The rate of reaction was found to be independent of the concentration of the solution at 0.05 M and 0.10 M.

Concentration of the solution (M)	Rate of reaction (sec ⁻¹)	Rate of reaction (sec ⁻¹)	Rate of reaction (sec ⁻¹)	Rate of reaction (sec ⁻¹)
0.01	0.001	0.001	0.001	0.001
0.02	0.001	0.001	0.001	0.001
0.05	0.001	0.001	0.001	0.001
0.10	0.001	0.001	0.001	0.001
0.01	0.001	0.001	0.001	0.001
0.02	0.001	0.001	0.001	0.001
0.05	0.001	0.001	0.001	0.001
0.10	0.001	0.001	0.001	0.001
0.01	0.001	0.001	0.001	0.001
0.02	0.001	0.001	0.001	0.001
0.05	0.001	0.001	0.001	0.001
0.10	0.001	0.001	0.001	0.001

B E A R I N G D

Table No. 9 Date July 14th, 1915.

Bearing Load, LBS. 300 Time, beginning of run _____

Room Temp.° Fahr. 74 Time, end of run 12:00 M.

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.075	2400	2.36	0.0900	0.00647	0.00386	
0.065	2184	2.05	0.0712	0.00563	0.00336	
0.06	1924	1.89	0.0578	0.00519	0.00309	
0.055	1687	1.73	0.0464	0.00475	0.00283	
0.05	1594	1.58	0.0398	0.00433	0.00258	
0.045	1264	1.42	0.0285	0.00390	0.00232	
0.045	1117	1.42	0.0252	0.00390	0.00232	
0.05	985	1.58	0.0246	0.00433	0.00258	
0.055	876	1.73	0.0242	0.00475	0.00283	
0.055	679	1.73	0.0187	0.00475	0.00283	
0.05	483	1.58	0.0121	0.00433	0.00258	
0.045	290	1.42	0.0065	0.00390	0.00232	
0.04	151	1.26	0.0031	0.00346	0.00206	
0.02	88	0.63	0.0009	0.00173	0.00103	

Remarks:— Excessive collar friction during run.

TABLE I

Summary of the results of the experiments on the effect of the concentration of the solution of the polymer on the rate of polymerization. The experiments were carried out at 30°C. in a 0.1M solution of the monomer in a 0.1M solution of the polymer. The rate of polymerization was measured by the change in viscosity of the solution during the reaction.

Concentration of the polymer solution (g./100 ml.)	Rate of polymerization (ml. of monomer consumed per hour)	Viscosity of the solution (poise)
0.1	0.1	0.1
0.2	0.2	0.2
0.3	0.3	0.3
0.4	0.4	0.4
0.5	0.5	0.5
0.6	0.6	0.6
0.7	0.7	0.7
0.8	0.8	0.8
0.9	0.9	0.9
1.0	1.0	1.0
1.1	1.1	1.1
1.2	1.2	1.2
1.3	1.3	1.3
1.4	1.4	1.4
1.5	1.5	1.5
1.6	1.6	1.6
1.7	1.7	1.7
1.8	1.8	1.8
1.9	1.9	1.9
2.0	2.0	2.0

The rate of polymerization was measured by the change in viscosity of the solution during the reaction.

DATA INTERPOLATED
FROM TABLES 1—9

Bearing D

R. P. M. of Shaft 2000

Table No. 10

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.145	0.0024	0.00155
1350	0.104	0.0022	0.0013
1200	0.092	0.0019	0.0011
1050	0.091	0.0023	0.0014
900	0.08	0.0025	0.0015
750	0.07	0.0025	0.0015
600	0.068	0.003	0.0017
450	0.06	0.0036	0.0025
300	0.06	0.0051	0.0033

Remarks:—

DATA INTERPOLATED
FROM TABLES 1—9

Bearing D

R. P. M. of Shaft 1600

Table No. 11

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.087	0.002	0.0012
1350	0.065	0.002	0.001
1200	0.065	0.0017	0.0009
1050	0.067	0.002	0.0012
900	0.051	0.002	0.0012
750	0.048	0.0021	0.0012
600	0.042	0.0025	0.0013
450	0.042	0.0028	0.0017
300	0.043	0.0041	0.0026

Remarks:—

TABLE I			
Summary of the results of the experiments			
Experiment	Time (min)	Distance (m)	Speed (m/min)
1	10	1.0	0.10
2	20	2.0	0.10
3	30	3.0	0.10
4	40	4.0	0.10
5	50	5.0	0.10
6	60	6.0	0.10
7	70	7.0	0.10
8	80	8.0	0.10
9	90	9.0	0.10
10	100	10.0	0.10
11	110	11.0	0.10
12	120	12.0	0.10
13	130	13.0	0.10
14	140	14.0	0.10
15	150	15.0	0.10
16	160	16.0	0.10
17	170	17.0	0.10
18	180	18.0	0.10
19	190	19.0	0.10
20	200	20.0	0.10
21	210	21.0	0.10
22	220	22.0	0.10
23	230	23.0	0.10
24	240	24.0	0.10
25	250	25.0	0.10
26	260	26.0	0.10
27	270	27.0	0.10
28	280	28.0	0.10
29	290	29.0	0.10
30	300	30.0	0.10
31	310	31.0	0.10
32	320	32.0	0.10
33	330	33.0	0.10
34	340	34.0	0.10
35	350	35.0	0.10
36	360	36.0	0.10
37	370	37.0	0.10
38	380	38.0	0.10
39	390	39.0	0.10
40	400	40.0	0.10
41	410	41.0	0.10
42	420	42.0	0.10
43	430	43.0	0.10
44	440	44.0	0.10
45	450	45.0	0.10
46	460	46.0	0.10
47	470	47.0	0.10
48	480	48.0	0.10
49	490	49.0	0.10
50	500	50.0	0.10
51	510	51.0	0.10
52	520	52.0	0.10
53	530	53.0	0.10
54	540	54.0	0.10
55	550	55.0	0.10
56	560	56.0	0.10
57	570	57.0	0.10
58	580	58.0	0.10
59	590	59.0	0.10
60	600	60.0	0.10
61	610	61.0	0.10
62	620	62.0	0.10
63	630	63.0	0.10
64	640	64.0	0.10
65	650	65.0	0.10
66	660	66.0	0.10
67	670	67.0	0.10
68	680	68.0	0.10
69	690	69.0	0.10
70	700	70.0	0.10
71	710	71.0	0.10
72	720	72.0	0.10
73	730	73.0	0.10
74	740	74.0	0.10
75	750	75.0	0.10
76	760	76.0	0.10
77	770	77.0	0.10
78	780	78.0	0.10
79	790	79.0	0.10
80	800	80.0	0.10
81	810	81.0	0.10
82	820	82.0	0.10
83	830	83.0	0.10
84	840	84.0	0.10
85	850	85.0	0.10
86	860	86.0	0.10
87	870	87.0	0.10
88	880	88.0	0.10
89	890	89.0	0.10
90	900	90.0	0.10
91	910	91.0	0.10
92	920	92.0	0.10
93	930	93.0	0.10
94	940	94.0	0.10
95	950	95.0	0.10
96	960	96.0	0.10
97	970	97.0	0.10
98	980	98.0	0.10
99	990	99.0	0.10
100	1000	100.0	0.10

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ D _____

R. P. M. of Shaft _____ 1200 _____

Table No. 12 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.056	0.0017	0.001
1350	0.043	0.0015	0.0009
1200	0.04	0.0015	0.0007
1050	0.044	0.0017	0.0009
900	0.031	0.0018	0.001
750	0.032	0.002	0.001
600	0.028	0.0022	0.0011
450	0.028	0.0024	0.0014
300	0.031	0.0038	0.0024

Remarks:—

TABLE I			
Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction			
Concentration of the solution (M)	Rate of the reaction (M/min)	Rate of the reaction (M/min)	Rate of the reaction (M/min)
0.01	0.001	0.001	0.001
0.02	0.002	0.002	0.002
0.03	0.003	0.003	0.003
0.04	0.004	0.004	0.004
0.05	0.005	0.005	0.005
0.06	0.006	0.006	0.006
0.07	0.007	0.007	0.007
0.08	0.008	0.008	0.008
0.09	0.009	0.009	0.009
0.10	0.010	0.010	0.010
0.11	0.011	0.011	0.011
0.12	0.012	0.012	0.012
0.13	0.013	0.013	0.013
0.14	0.014	0.014	0.014
0.15	0.015	0.015	0.015
0.16	0.016	0.016	0.016
0.17	0.017	0.017	0.017
0.18	0.018	0.018	0.018
0.19	0.019	0.019	0.019
0.20	0.020	0.020	0.020
0.21	0.021	0.021	0.021
0.22	0.022	0.022	0.022
0.23	0.023	0.023	0.023
0.24	0.024	0.024	0.024
0.25	0.025	0.025	0.025
0.26	0.026	0.026	0.026
0.27	0.027	0.027	0.027
0.28	0.028	0.028	0.028
0.29	0.029	0.029	0.029
0.30	0.030	0.030	0.030
0.31	0.031	0.031	0.031
0.32	0.032	0.032	0.032
0.33	0.033	0.033	0.033
0.34	0.034	0.034	0.034
0.35	0.035	0.035	0.035
0.36	0.036	0.036	0.036
0.37	0.037	0.037	0.037
0.38	0.038	0.038	0.038
0.39	0.039	0.039	0.039
0.40	0.040	0.040	0.040
0.41	0.041	0.041	0.041
0.42	0.042	0.042	0.042
0.43	0.043	0.043	0.043
0.44	0.044	0.044	0.044
0.45	0.045	0.045	0.045
0.46	0.046	0.046	0.046
0.47	0.047	0.047	0.047
0.48	0.048	0.048	0.048
0.49	0.049	0.049	0.049
0.50	0.050	0.050	0.050
0.51	0.051	0.051	0.051
0.52	0.052	0.052	0.052
0.53	0.053	0.053	0.053
0.54	0.054	0.054	0.054
0.55	0.055	0.055	0.055
0.56	0.056	0.056	0.056
0.57	0.057	0.057	0.057
0.58	0.058	0.058	0.058
0.59	0.059	0.059	0.059
0.60	0.060	0.060	0.060
0.61	0.061	0.061	0.061
0.62	0.062	0.062	0.062
0.63	0.063	0.063	0.063
0.64	0.064	0.064	0.064
0.65	0.065	0.065	0.065
0.66	0.066	0.066	0.066
0.67	0.067	0.067	0.067
0.68	0.068	0.068	0.068
0.69	0.069	0.069	0.069
0.70	0.070	0.070	0.070
0.71	0.071	0.071	0.071
0.72	0.072	0.072	0.072
0.73	0.073	0.073	0.073
0.74	0.074	0.074	0.074
0.75	0.075	0.075	0.075
0.76	0.076	0.076	0.076
0.77	0.077	0.077	0.077
0.78	0.078	0.078	0.078
0.79	0.079	0.079	0.079
0.80	0.080	0.080	0.080
0.81	0.081	0.081	0.081
0.82	0.082	0.082	0.082
0.83	0.083	0.083	0.083
0.84	0.084	0.084	0.084
0.85	0.085	0.085	0.085
0.86	0.086	0.086	0.086
0.87	0.087	0.087	0.087
0.88	0.088	0.088	0.088
0.89	0.089	0.089	0.089
0.90	0.090	0.090	0.090
0.91	0.091	0.091	0.091
0.92	0.092	0.092	0.092
0.93	0.093	0.093	0.093
0.94	0.094	0.094	0.094
0.95	0.095	0.095	0.095
0.96	0.096	0.096	0.096
0.97	0.097	0.097	0.097
0.98	0.098	0.098	0.098
0.99	0.099	0.099	0.099
1.00	0.100	0.100	0.100

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ D _____

R. P. M. of Shaft _____ 800 _____

Table No. **13** _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.035	0.0014	0.0007
1350	0.026	0.0013	0.0005
1200	0.02	0.0012	0.0005
1050	0.024	0.0015	0.0006
900	0.02	0.0015	0.0006
750	0.02	0.0019	0.0009
600	0.015	0.002	0.0009
450	0.016	0.002	0.0011
300	0.021	0.0047	0.0021

Remarks:—

TABLE I			
Summary of the results of the experiments			
Experiment	Time (min)	Distance (m)	Speed (m/min)
1	10	100	10
2	15	150	10
3	20	200	10
4	25	250	10
5	30	300	10
6	35	350	10
7	40	400	10
8	45	450	10
9	50	500	10
10	55	550	10
11	60	600	10
12	65	650	10
13	70	700	10
14	75	750	10
15	80	800	10
16	85	850	10
17	90	900	10
18	95	950	10
19	100	1000	10
20	105	1050	10
21	110	1100	10
22	115	1150	10
23	120	1200	10
24	125	1250	10
25	130	1300	10
26	135	1350	10
27	140	1400	10
28	145	1450	10
29	150	1500	10
30	155	1550	10
31	160	1600	10
32	165	1650	10
33	170	1700	10
34	175	1750	10
35	180	1800	10
36	185	1850	10
37	190	1900	10
38	195	1950	10
39	200	2000	10
40	205	2050	10
41	210	2100	10
42	215	2150	10
43	220	2200	10
44	225	2250	10
45	230	2300	10
46	235	2350	10
47	240	2400	10
48	245	2450	10
49	250	2500	10
50	255	2550	10
51	260	2600	10
52	265	2650	10
53	270	2700	10
54	275	2750	10
55	280	2800	10
56	285	2850	10
57	290	2900	10
58	295	2950	10
59	300	3000	10
60	305	3050	10
61	310	3100	10
62	315	3150	10
63	320	3200	10
64	325	3250	10
65	330	3300	10
66	335	3350	10
67	340	3400	10
68	345	3450	10
69	350	3500	10
70	355	3550	10
71	360	3600	10
72	365	3650	10
73	370	3700	10
74	375	3750	10
75	380	3800	10
76	385	3850	10
77	390	3900	10
78	395	3950	10
79	400	4000	10
80	405	4050	10
81	410	4100	10
82	415	4150	10
83	420	4200	10
84	425	4250	10
85	430	4300	10
86	435	4350	10
87	440	4400	10
88	445	4450	10
89	450	4500	10
90	455	4550	10
91	460	4600	10
92	465	4650	10
93	470	4700	10
94	475	4750	10
95	480	4800	10
96	485	4850	10
97	490	4900	10
98	495	4950	10
99	500	5000	10
100	505	5050	10

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ D _____

R. P. M. of Shaft _____ 600 _____

Table No. 14 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.024	0.0012	0.0005
1350	0.018	0.0011	0.0004
1200	0.012	0.001	0.0004
1050	0.015	0.0013	0.0005
900	0.015	0.0014	0.0005
750	0.015	0.0016	0.0008
600	0.011	0.0018	0.0008
450	0.01	0.0019	0.0010
300	0.017	0.005	0.0032

Remarks:—

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DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ D _____

R. P. M. of Shaft _____ 400 _____

Table No. **15** _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.014	0.001	0.0005
1350	0.011	0.001	0.0003
1200	0.007	0.001	0.0003
1050	0.008	0.0011	0.0004
900	0.01	0.001	0.0004
750	0.008	0.0015	0.0006
600	0.005	0.0015	0.0004
450	0.006	0.0016	0.0010
300	0.012	0.0045	0.0028

Remarks:—

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ D _____

R. P. M. of Shaft _____ 200 _____

Table No. 16 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.007	0.001	0.0004
1350	0.004	0.001	0.0003
1200	0.004	0.001	0.0003
1050	0.004	0.001	0.0003
900	0.004	0.001	0.0003
750	0.003	0.0009	0.0002
600	0.003	0.0009	0.0002
450	0.002	0.0013	0.0008
300	0.007	0.003	0.002

Remarks:—

CURVES PLOTTED FROM
TABLES 1 - 16
OF
BEARING "D"

STATE OF CALIFORNIA
COUNTY OF ALBANY
ss.
I, the undersigned,
Notary Public in and for the State of California,
do hereby certify that the foregoing is a true and correct
copy of the original of the same as the same appears
from the records of the County of Albany, State of California.

BEARING D. TABLE NO. 1.
BEARING LOAD 1500 LBS.
ROOM TEMP. 74° F.

HORSE POWER TO DRIVE

COEFFICIENT OF FRICTION

R. P. M. OF SHAFT

2400

2000

1600

1200

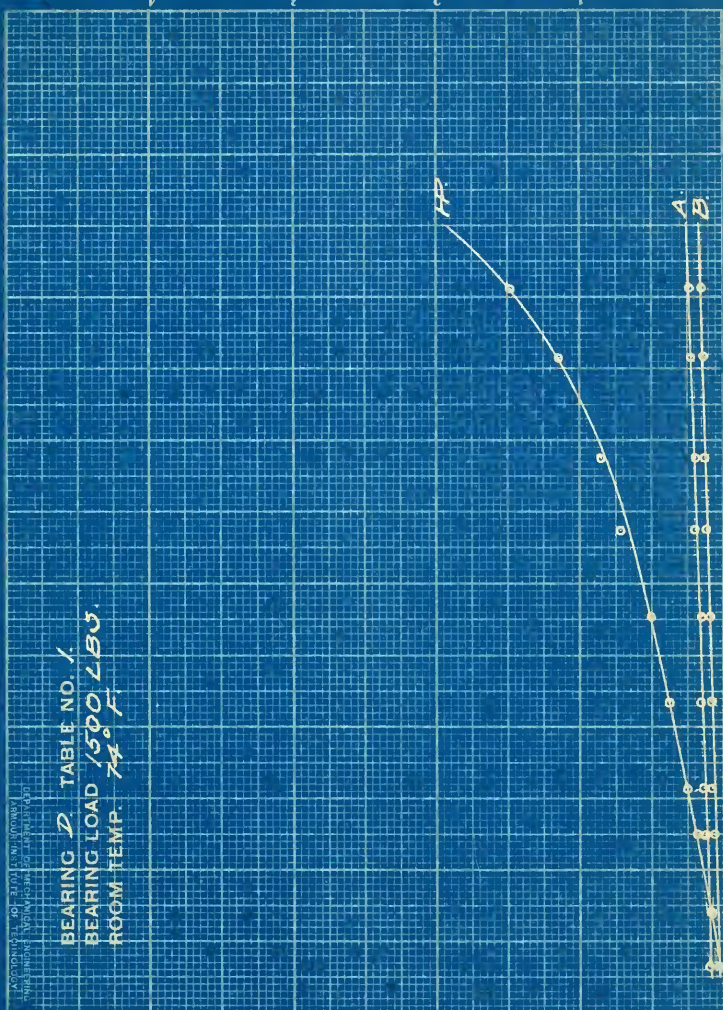
800

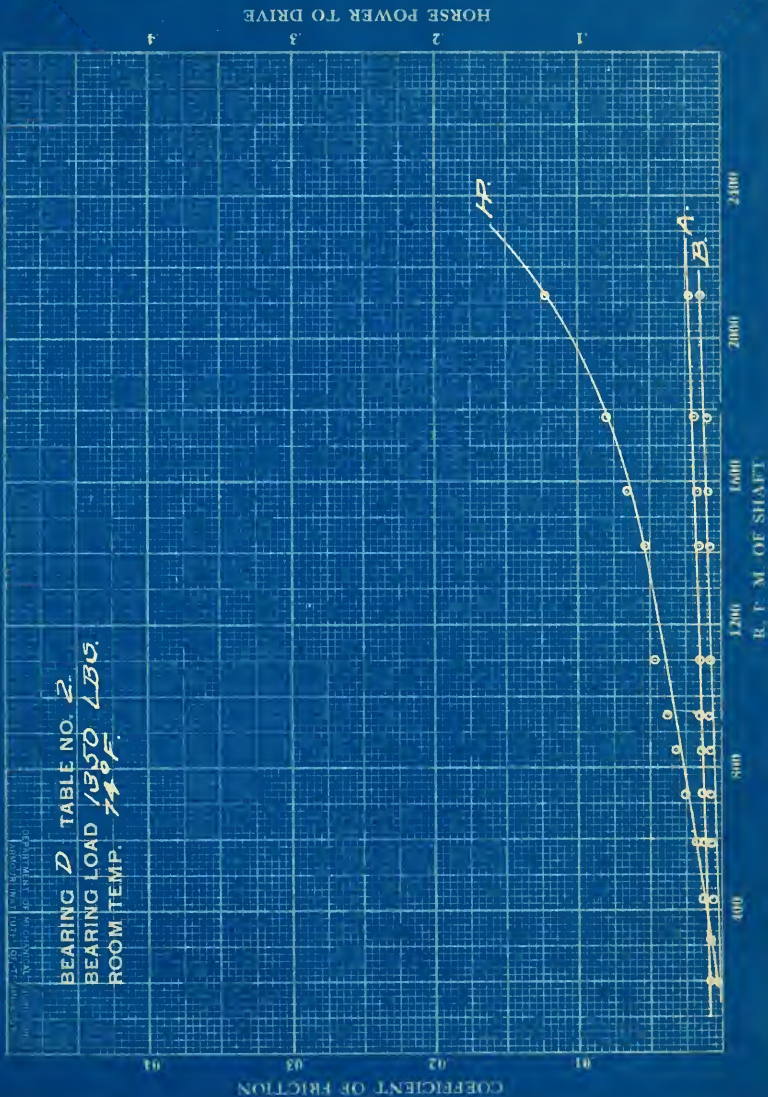
400

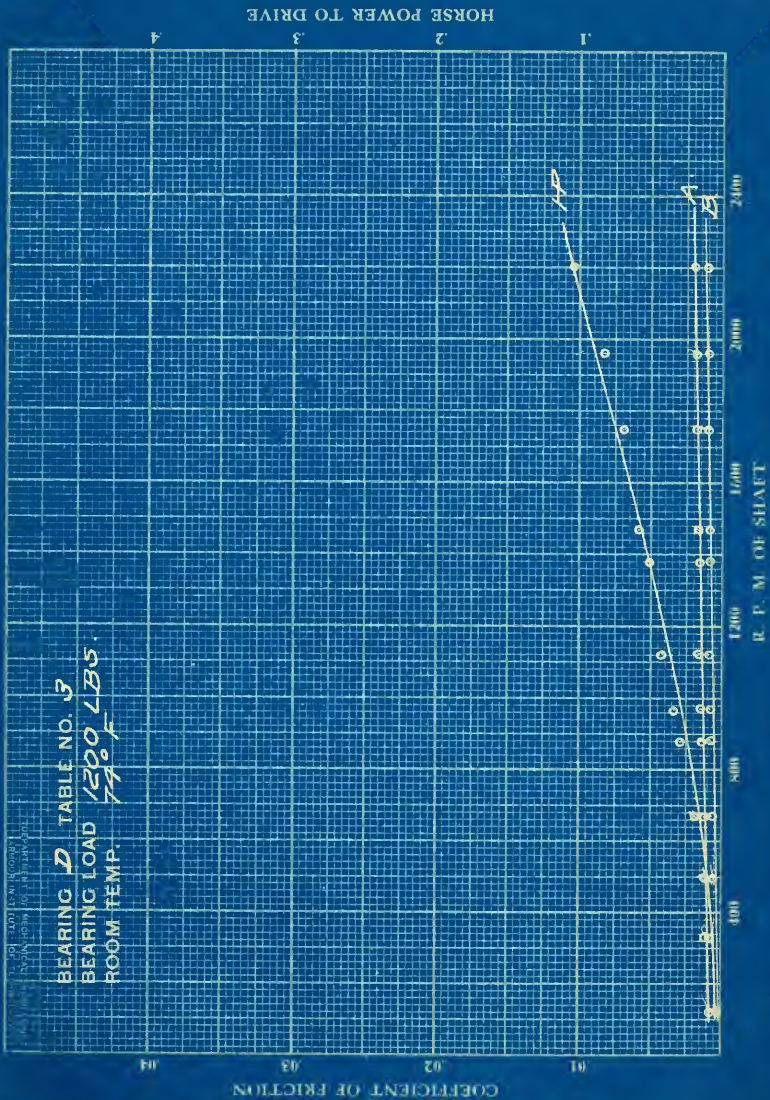
A

B

FF







ACCORDING TO THE FOLLOWING
TABLE, THE COEFFICIENT OF FRICTION
FOR THE FOLLOWING VALUES OF
R. P. M. OF SHAFT

BEARING D. TABLE NO. 7
BEARING LOAD 1050 LBS.
ROOM TEMP. 73°F

0.4

0.3

0.2

0.1

COEFFICIENT OF FRICTION

0.4

0.3

0.2

0.1

HORSE POWER TO DRIVE

R. P. M. OF SHAFT

400

800

1200

1600

2000

2400

A.

B.

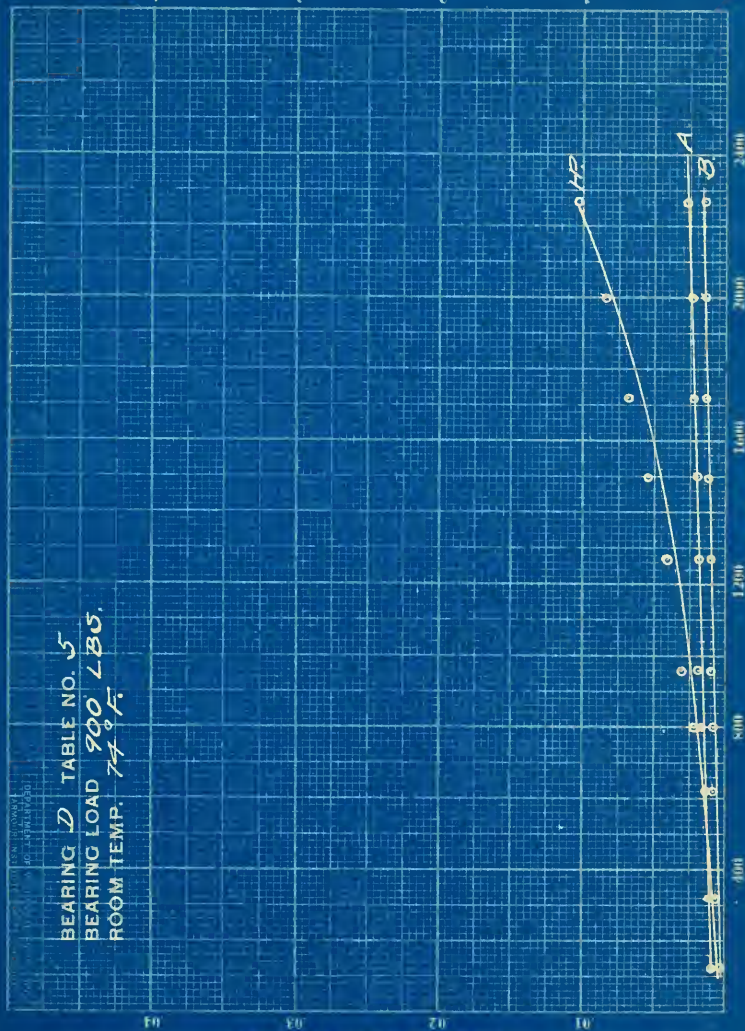
1.0

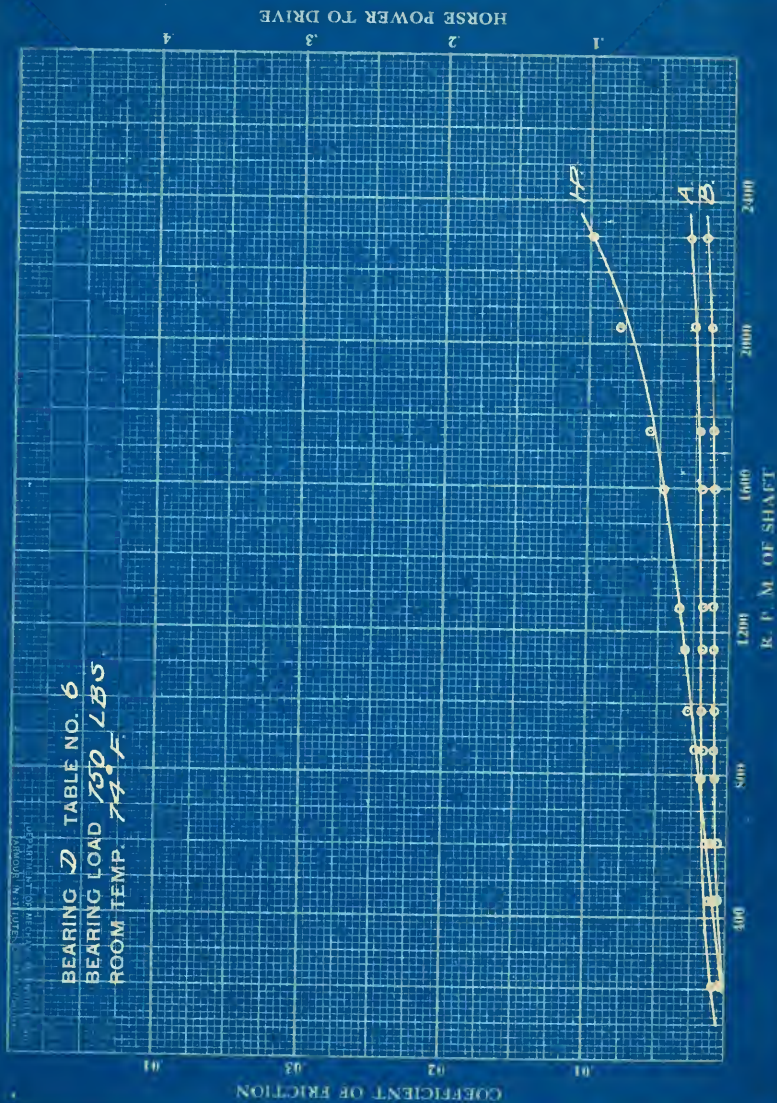
HORSE POWER TO DRIVE

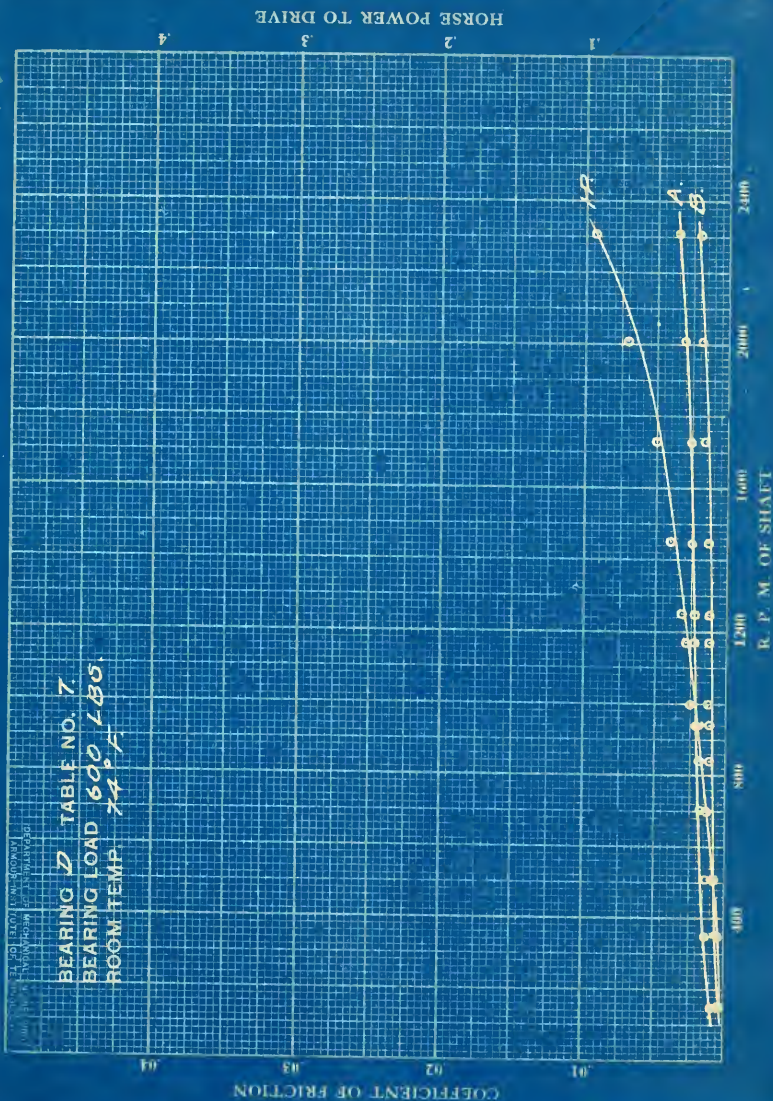
BEARING D TABLE NO. 5
 BEARING LOAD 900 LBS.
 ROOM TEMP. 74°F.

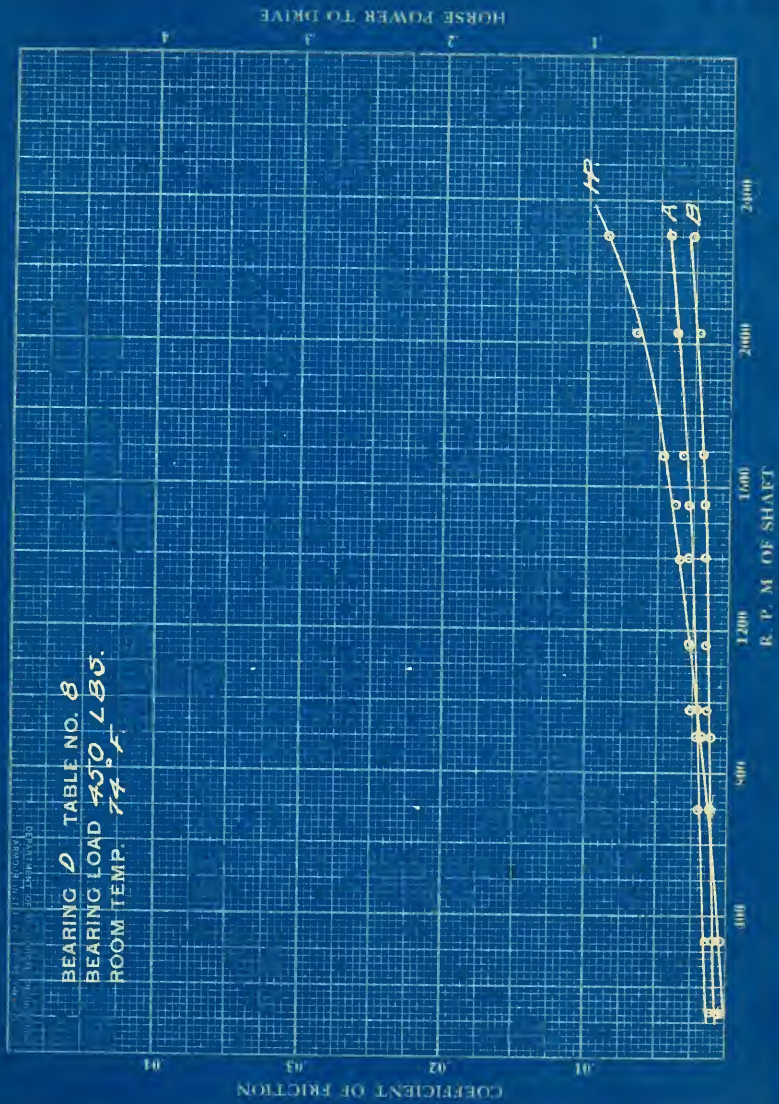
COEFFICIENT OF FRICTION

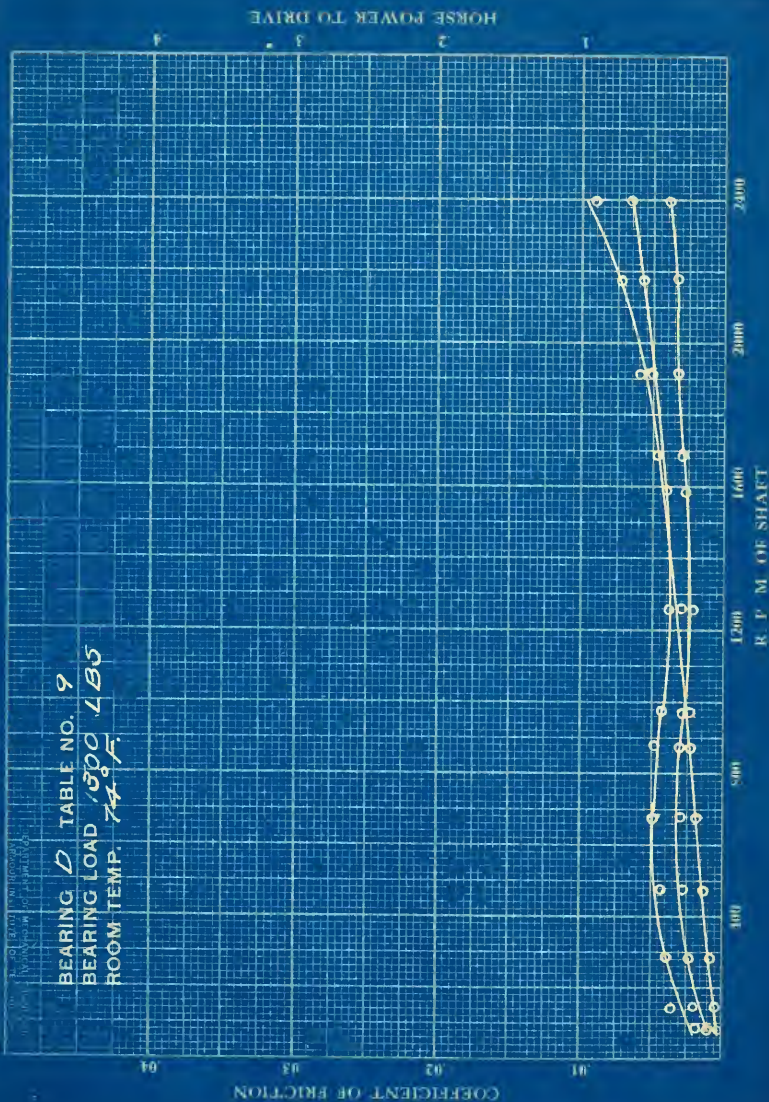
R. P. M. OF SHAFT

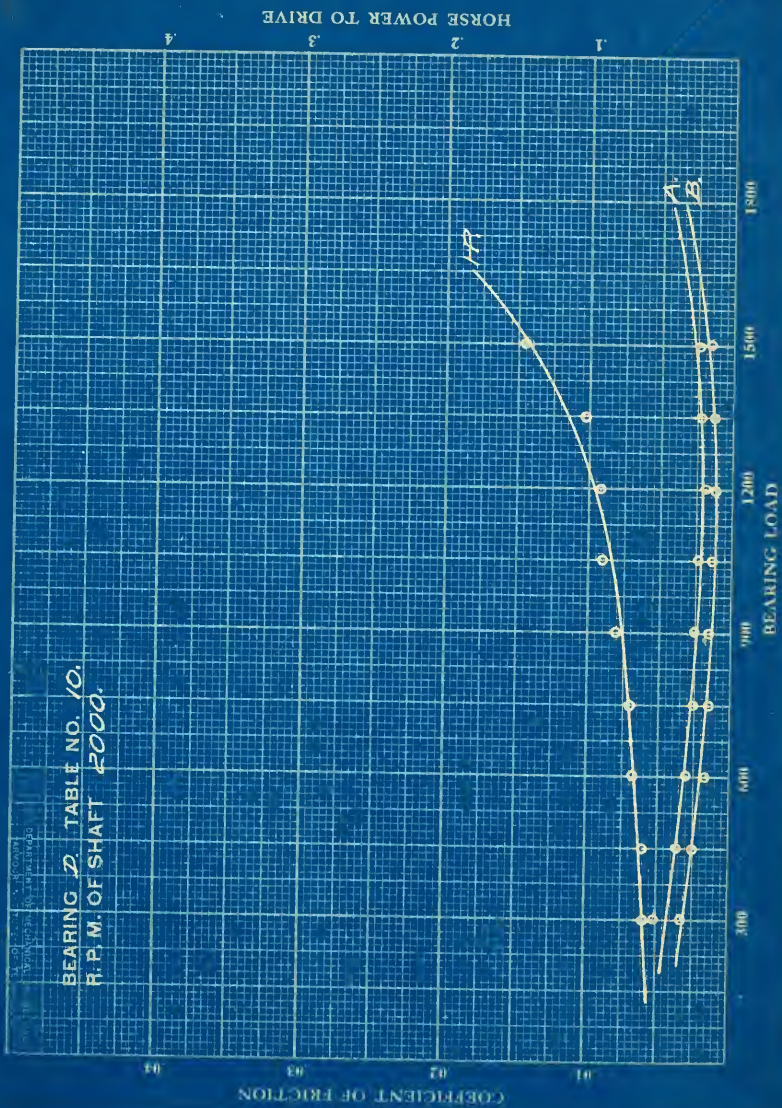


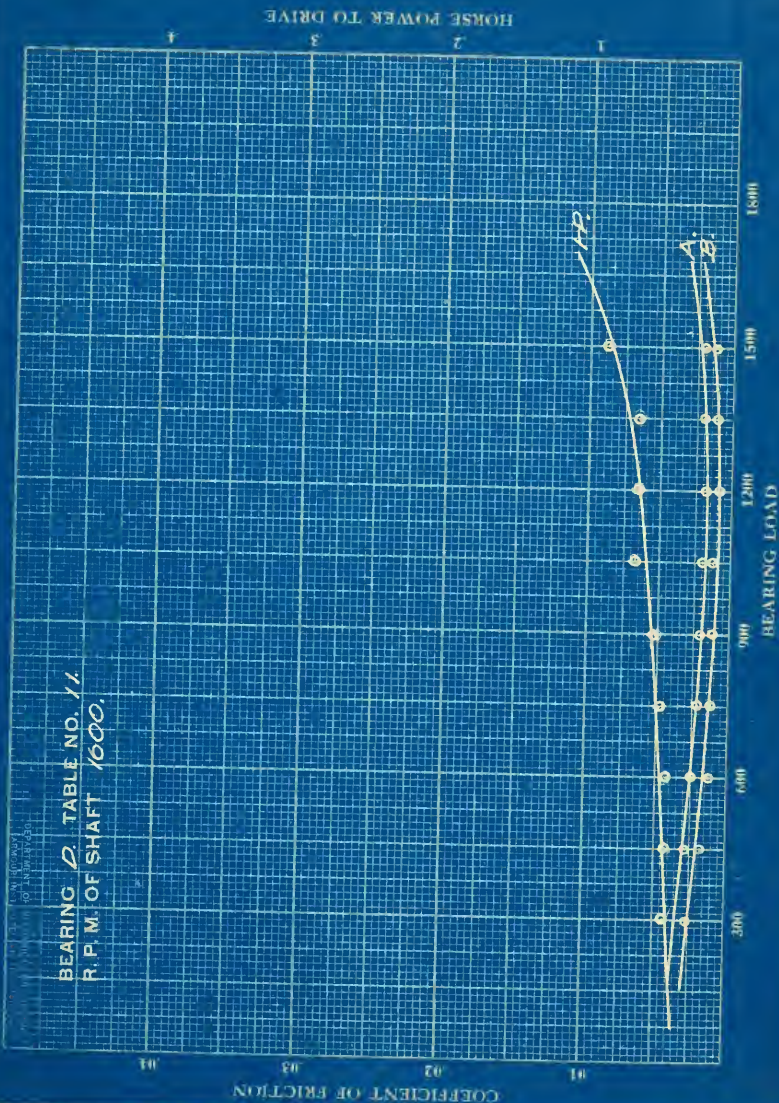


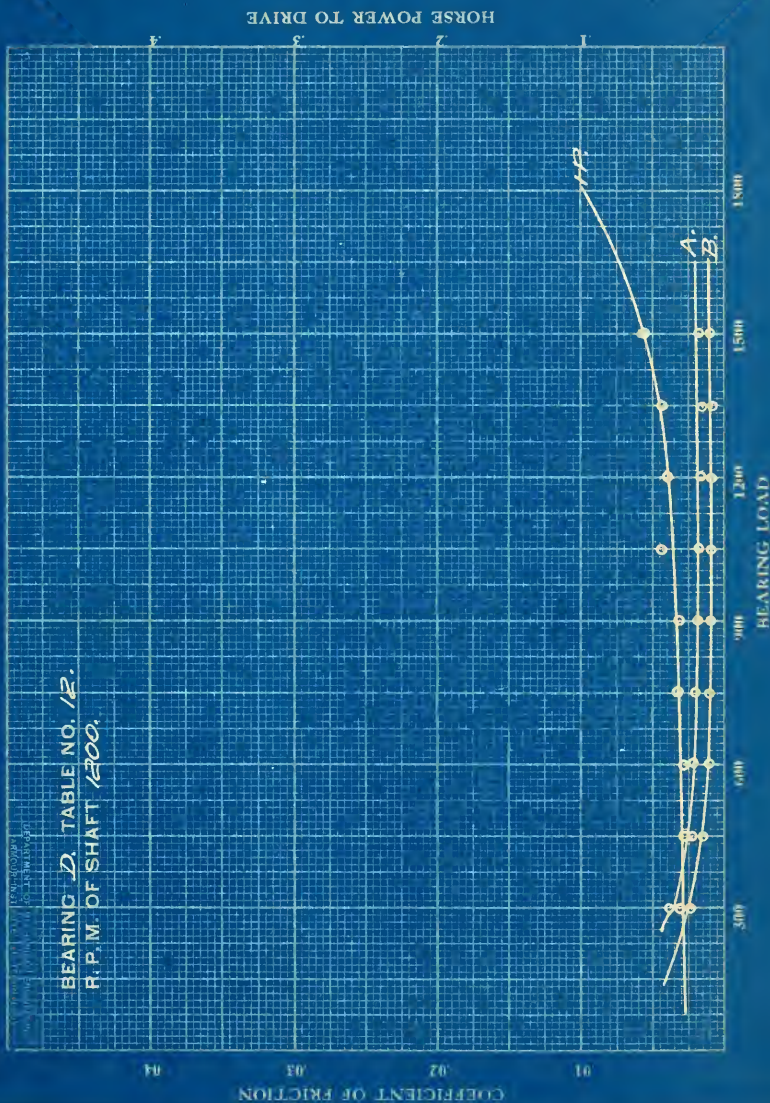


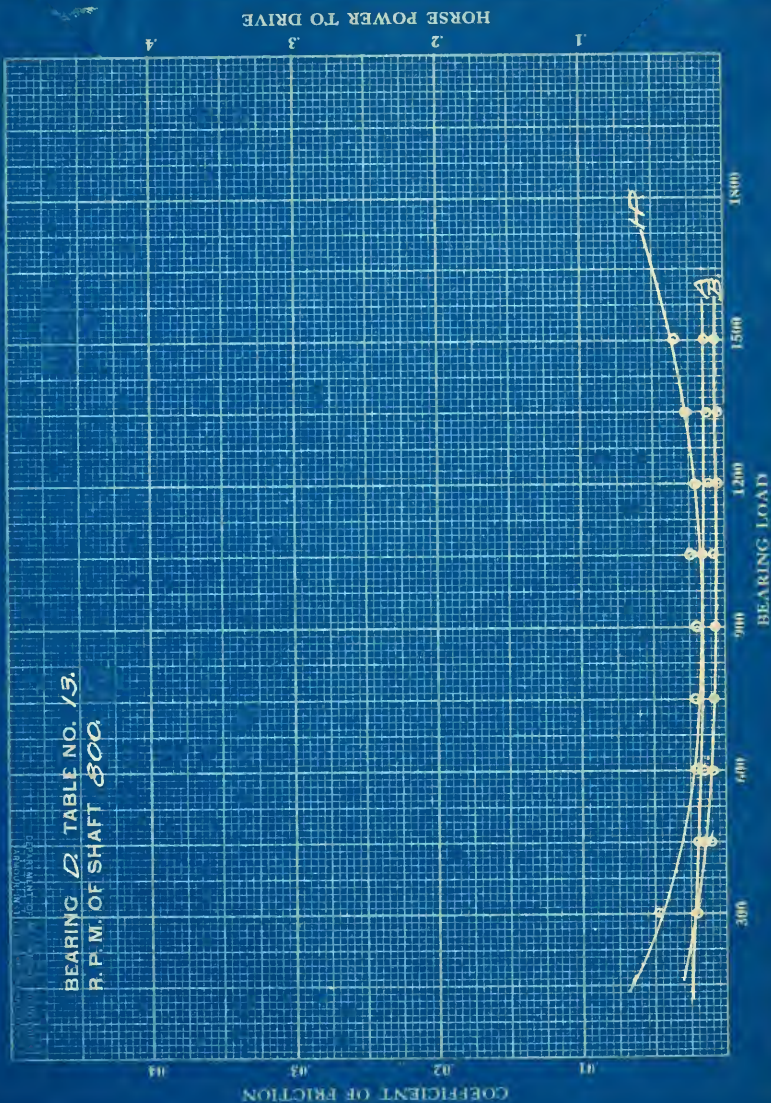




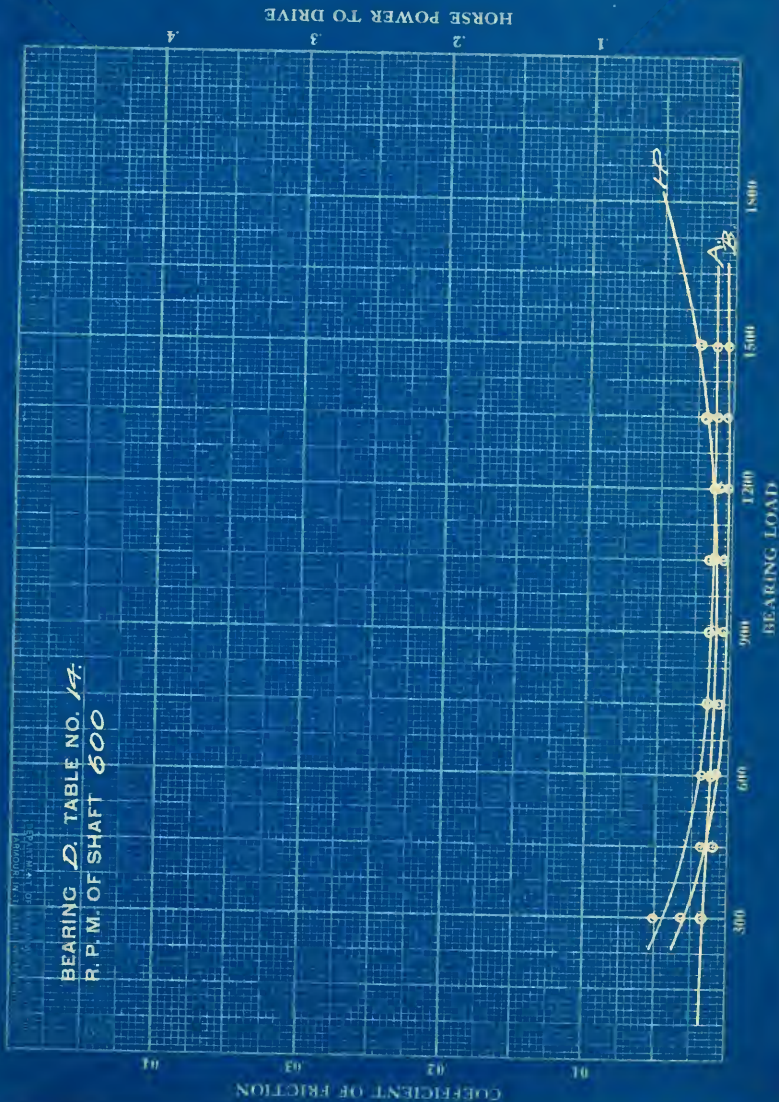


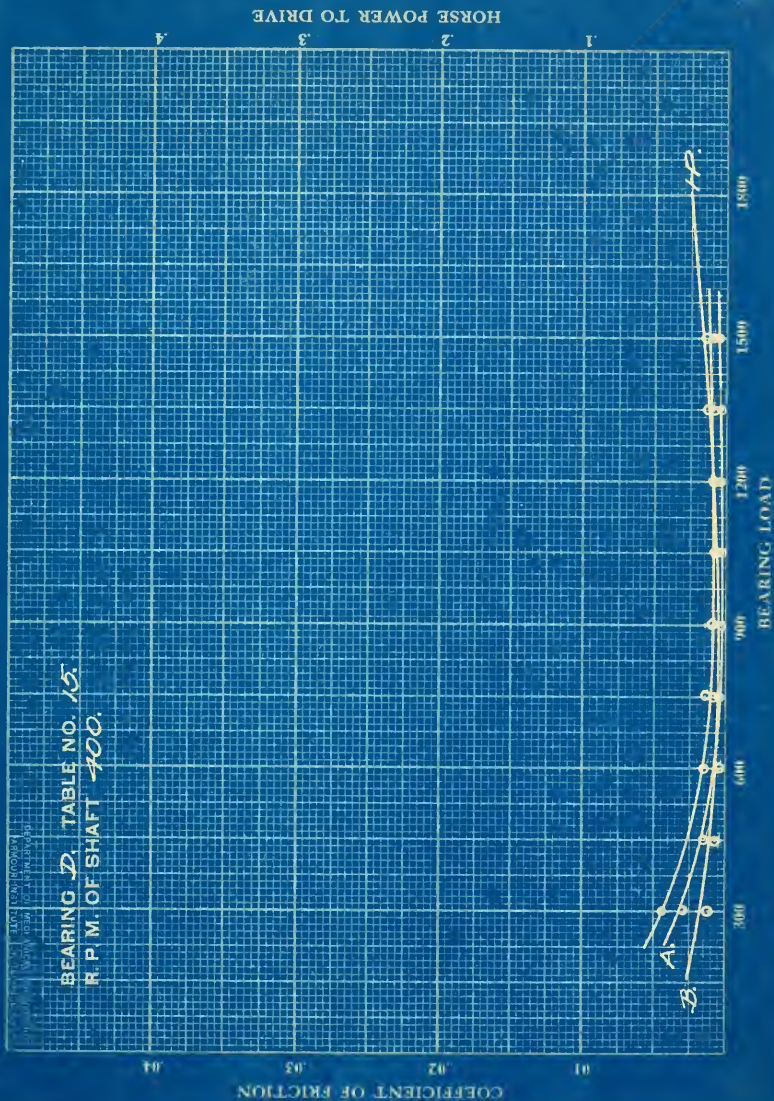






BEARING D, TABLE NO. 17.
R. P. M. OF SHAFT 600





BEARING D. TABLE NO. 16.
R.P.M. OF SHAFT 200.

HORSE POWER TO DRIVE

.4 .3 .2 .1

.04 .03 .02 .01

COEFFICIENT OF FRICTION

1800 1500 1200 900 600 300

BEARING LOAD

AR

APR 23

BEARING "E"



Fig. 14

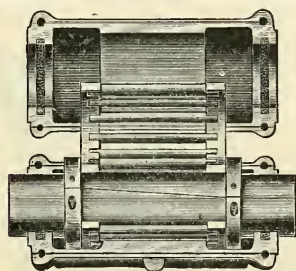


Fig. 15



BEARING "E"

Bearing "E", (Figures 14,15), is a roller bearing with a single roller structure, with all parts split so as to be able to apply the bearing to the shaft easily.

A split bushing or sleeve fits over the shaft and this is the raceway for the rolls. Two collars which clamp the split bushing to the shaft retain the roller structure, affording movable surfaces with which the ends of the roller structure come into contact. The collars do not touch the box, thereby, relieving the bearing from end thrust.

The rolls are held by a steel retainer and each retainer is split. A ground portion of the inside of the bearing box provides an outer raceway for the rolls. The grease is retained in the box by pieces of felt which fit into grooves in the ends of the bearing box.

The chief fault of this bearing is that when mounting the split bushing on the

"The first of these is the fact that the
 British Government has a strong interest in the
 East and that it is not likely to be able to
 maintain its position in the East without the
 aid of the United States. The British Government
 has a strong interest in the East and it is not
 likely to be able to maintain its position in the
 East without the aid of the United States. The
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 the aid of the United States. The British Govern-
 ment has a strong interest in the East and it is
 not likely to be able to maintain its position in
 the East without the aid of the United States.

shaft, it would never fit exactly around the circumference and consequently did not provide a perfectly cylindrical raceway for the rolls. The result of this, is, that there is a pounding up and down of the split retainer and an inability of the rolls to take their proper load. This caused a heating of the bearing and a comparatively high coefficient of friction.

During all runs, the felt oil retainers were removed as they were so tight against the shaft that they caused the bearing and shaft to heat up to a greater extent than was allowable, but, this fault could be easily overcome by the use of a better grade of felt and having a looser fit on the shaft.

While running under load, the bearing was quite noisy and prone to heat up to an alarming extent.

TABLES 1 - 13
OF
BEARING "E"

B E A R I N G E

Table No. 1 Date July 21st, 1915.
 Bearing Load, LBS. 1500 Time, beginning of run 8:58 A.M.
 Room Temp.° Fahr. 73 Time, end of run _____
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.82	526	25.05	0.215	0.0137	0.01048
0.76	512	23.90	0.195	0.0131	0.0100
0.73	488	23.00	0.178	0.0126	0.00962
0.67	476	21.10	0.159	0.0116	0.00886
0.645	429	20.30	0.138	0.0111	0.00848
0.61	310	19.20	0.095	0.0105	0.00802
0.58	228	18.25	0.066	0.0100	0.00763

Remarks:— Considerable vibration noted during run.

B E A R I N G E

Table No. 2 Date July 21st, 1915.
 Bearing Load, LBS. 1350 Time, beginning of run _____
 Room Temp. ° Fahr. 73 Time, end of run _____
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.73	564	23.30		0.208	0.0142	0.01083
0.68	551	21.40		0.188	0.0131	0.0100
0.67	528	21.10		0.177	0.0128	0.00977
0.57	469	17.95		0.132	0.0109	0.00832
0.495	442	15.60		0.110	0.0095	0.00725
0.48	319	15.10		0.077	0.0092	0.00703
0.47	237	14.80		0.056	0.0090	0.00688

Remarks:—

B E A R I N G E

Table No. 3 Date July 21st, 1915.
 Bearing Load, LBS. 1200 Time, beginning of run _____
 Room Temp. ° Fahr. 73 Time, end of run 9:33 A.M.
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.69	618	21.70	0.213	0.0148	0.01130	
0.575	602	18.10	0.173	0.0124	0.00947	
0.48	536	15.10	0.129	0.0104	0.00794	
0.445	433	14.00	0.096	0.0096	0.00733	
0.425	401	13.40	0.085	0.0092	0.00703	
0.42	364	13.21	0.077	0.0091	0.00695	
0.43	284	13.52	0.061	0.0093	0.00710	
0.445	258	14.00	0.058	0.0096	0.00733	
0.46	200	14.48	0.046	0.0099	0.00755	

Remarks:—

B E A R I N G E

Table No. 4 Date July 21st, 1915.
 Bearing Load, LBS. 1050 Time, beginning of run 9:35 A.M.
 Room Temp.° Fahr. 73 Time, end of run _____
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE Inch Lbs.	Horse Power to Drive	COEFFICIENT OF FRICTION	
				Shaft	Bearing
0.56	626	17.62	0.175	0.0138	0.01053
0.49	607	15.42	0.149	0.0121	0.00925
0.43	570	13.53	0.123	0.0106	0.00809
0.415	461	13.08	0.096	0.0102	0.00779
0.39	425	12.28	0.083	0.0096	0.00733
0.36	383	11.34	0.069	0.0089	0.00679
0.375	316	11.80	0.059	0.0092	0.00703
0.37	311	11.64	0.057	0.0091	0.00695
0.385	258	12.12	0.050	0.0095	0.00725
0.405	180	12.73	0.036	0.0100	0.00754

Remarks:—

TABLE I

Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction between the solution and the solid substance.

Concentration of the solution		Rate of the reaction		Time	
g/l.	ml.	g/l.	ml.	min.	sec.
1.0	100	1.0	100	10	0
1.0	100	1.0	100	20	0
1.0	100	1.0	100	30	0
1.0	100	1.0	100	40	0
1.0	100	1.0	100	50	0
1.0	100	1.0	100	60	0
1.0	100	1.0	100	70	0
1.0	100	1.0	100	80	0
1.0	100	1.0	100	90	0
1.0	100	1.0	100	100	0
1.0	100	1.0	100	110	0
1.0	100	1.0	100	120	0
1.0	100	1.0	100	130	0
1.0	100	1.0	100	140	0
1.0	100	1.0	100	150	0
1.0	100	1.0	100	160	0
1.0	100	1.0	100	170	0
1.0	100	1.0	100	180	0
1.0	100	1.0	100	190	0
1.0	100	1.0	100	200	0
1.0	100	1.0	100	210	0
1.0	100	1.0	100	220	0
1.0	100	1.0	100	230	0
1.0	100	1.0	100	240	0
1.0	100	1.0	100	250	0
1.0	100	1.0	100	260	0
1.0	100	1.0	100	270	0
1.0	100	1.0	100	280	0
1.0	100	1.0	100	290	0
1.0	100	1.0	100	300	0
1.0	100	1.0	100	310	0
1.0	100	1.0	100	320	0
1.0	100	1.0	100	330	0
1.0	100	1.0	100	340	0
1.0	100	1.0	100	350	0
1.0	100	1.0	100	360	0
1.0	100	1.0	100	370	0
1.0	100	1.0	100	380	0
1.0	100	1.0	100	390	0
1.0	100	1.0	100	400	0
1.0	100	1.0	100	410	0
1.0	100	1.0	100	420	0
1.0	100	1.0	100	430	0
1.0	100	1.0	100	440	0
1.0	100	1.0	100	450	0
1.0	100	1.0	100	460	0
1.0	100	1.0	100	470	0
1.0	100	1.0	100	480	0
1.0	100	1.0	100	490	0
1.0	100	1.0	100	500	0
1.0	100	1.0	100	510	0
1.0	100	1.0	100	520	0
1.0	100	1.0	100	530	0
1.0	100	1.0	100	540	0
1.0	100	1.0	100	550	0
1.0	100	1.0	100	560	0
1.0	100	1.0	100	570	0
1.0	100	1.0	100	580	0
1.0	100	1.0	100	590	0
1.0	100	1.0	100	600	0
1.0	100	1.0	100	610	0
1.0	100	1.0	100	620	0
1.0	100	1.0	100	630	0
1.0	100	1.0	100	640	0
1.0	100	1.0	100	650	0
1.0	100	1.0	100	660	0
1.0	100	1.0	100	670	0
1.0	100	1.0	100	680	0
1.0	100	1.0	100	690	0
1.0	100	1.0	100	700	0
1.0	100	1.0	100	710	0
1.0	100	1.0	100	720	0
1.0	100	1.0	100	730	0
1.0	100	1.0	100	740	0
1.0	100	1.0	100	750	0
1.0	100	1.0	100	760	0
1.0	100	1.0	100	770	0
1.0	100	1.0	100	780	0
1.0	100	1.0	100	790	0
1.0	100	1.0	100	800	0
1.0	100	1.0	100	810	0
1.0	100	1.0	100	820	0
1.0	100	1.0	100	830	0
1.0	100	1.0	100	840	0
1.0	100	1.0	100	850	0
1.0	100	1.0	100	860	0
1.0	100	1.0	100	870	0
1.0	100	1.0	100	880	0
1.0	100	1.0	100	890	0
1.0	100	1.0	100	900	0
1.0	100	1.0	100	910	0
1.0	100	1.0	100	920	0
1.0	100	1.0	100	930	0
1.0	100	1.0	100	940	0
1.0	100	1.0	100	950	0
1.0	100	1.0	100	960	0
1.0	100	1.0	100	970	0
1.0	100	1.0	100	980	0
1.0	100	1.0	100	990	0
1.0	100	1.0	100	1000	0

BEARING E

Table No. 5 Date July 21st, 1915.

Bearing Load, LBS. 900 Time, beginning of run _____

Room Temp.° Fahr. 73 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

[illegible]

Remarks:—

TABLE 1

Summary of the results of the analysis of variance for the effect of the treatment on the yield of the different components of the plant.

Treatment	Yield of roots	Yield of stems	Yield of leaves	Yield of flowers	Yield of fruits
Control	1.2	1.5	1.8	2.1	2.4
T1	1.3	1.6	1.9	2.2	2.5
T2	1.4	1.7	2.0	2.3	2.6
T3	1.5	1.8	2.1	2.4	2.7
T4	1.6	1.9	2.2	2.5	2.8
T5	1.7	2.0	2.3	2.6	2.9
T6	1.8	2.1	2.4	2.7	3.0
T7	1.9	2.2	2.5	2.8	3.1
T8	2.0	2.3	2.6	2.9	3.2
T9	2.1	2.4	2.7	3.0	3.3
T10	2.2	2.5	2.8	3.1	3.4
T11	2.3	2.6	2.9	3.2	3.5
T12	2.4	2.7	3.0	3.3	3.6
T13	2.5	2.8	3.1	3.4	3.7
T14	2.6	2.9	3.2	3.5	3.8
T15	2.7	3.0	3.3	3.6	3.9
T16	2.8	3.1	3.4	3.7	4.0
T17	2.9	3.2	3.5	3.8	4.1
T18	3.0	3.3	3.6	3.9	4.2
T19	3.1	3.4	3.7	4.0	4.3
T20	3.2	3.5	3.8	4.1	4.4
T21	3.3	3.6	3.9	4.2	4.5
T22	3.4	3.7	4.0	4.3	4.6
T23	3.5	3.8	4.1	4.4	4.7
T24	3.6	3.9	4.2	4.5	4.8
T25	3.7	4.0	4.3	4.6	4.9
T26	3.8	4.1	4.4	4.7	5.0
T27	3.9	4.2	4.5	4.8	5.1
T28	4.0	4.3	4.6	4.9	5.2
T29	4.1	4.4	4.7	5.0	5.3
T30	4.2	4.5	4.8	5.1	5.4
T31	4.3	4.6	4.9	5.2	5.5
T32	4.4	4.7	5.0	5.3	5.6
T33	4.5	4.8	5.1	5.4	5.7
T34	4.6	4.9	5.2	5.5	5.8
T35	4.7	5.0	5.3	5.6	5.9
T36	4.8	5.1	5.4	5.7	6.0
T37	4.9	5.2	5.5	5.8	6.1
T38	5.0	5.3	5.6	5.9	6.2
T39	5.1	5.4	5.7	6.0	6.3
T40	5.2	5.5	5.8	6.1	6.4
T41	5.3	5.6	5.9	6.2	6.5
T42	5.4	5.7	6.0	6.3	6.6
T43	5.5	5.8	6.1	6.4	6.7
T44	5.6	5.9	6.2	6.5	6.8
T45	5.7	6.0	6.3	6.6	6.9
T46	5.8	6.1	6.4	6.7	7.0
T47	5.9	6.2	6.5	6.8	7.1
T48	6.0	6.3	6.6	6.9	7.2
T49	6.1	6.4	6.7	7.0	7.3
T50	6.2	6.5	6.8	7.1	7.4
T51	6.3	6.6	6.9	7.2	7.5
T52	6.4	6.7	7.0	7.3	7.6
T53	6.5	6.8	7.1	7.4	7.7
T54	6.6	6.9	7.2	7.5	7.8
T55	6.7	7.0	7.3	7.6	7.9
T56	6.8	7.1	7.4	7.7	8.0
T57	6.9	7.2	7.5	7.8	8.1
T58	7.0	7.3	7.6	7.9	8.2
T59	7.1	7.4	7.7	8.0	8.3
T60	7.2	7.5	7.8	8.1	8.4
T61	7.3	7.6	7.9	8.2	8.5
T62	7.4	7.7	8.0	8.3	8.6
T63	7.5	7.8	8.1	8.4	8.7
T64	7.6	7.9	8.2	8.5	8.8
T65	7.7	8.0	8.3	8.6	8.9
T66	7.8	8.1	8.4	8.7	9.0
T67	7.9	8.2	8.5	8.8	9.1
T68	8.0	8.3	8.6	8.9	9.2
T69	8.1	8.4	8.7	9.0	9.3
T70	8.2	8.5	8.8	9.1	9.4
T71	8.3	8.6	8.9	9.2	9.5
T72	8.4	8.7	9.0	9.3	9.6
T73	8.5	8.8	9.1	9.4	9.7
T74	8.6	8.9	9.2	9.5	9.8
T75	8.7	9.0	9.3	9.6	9.9
T76	8.8	9.1	9.4	9.7	10.0
T77	8.9	9.2	9.5	9.8	10.1
T78	9.0	9.3	9.6	9.9	10.2
T79	9.1	9.4	9.7	10.0	10.3
T80	9.2	9.5	9.8	10.1	10.4
T81	9.3	9.6	9.9	10.2	10.5
T82	9.4	9.7	10.0	10.3	10.6
T83	9.5	9.8	10.1	10.4	10.7
T84	9.6	9.9	10.2	10.5	10.8
T85	9.7	10.0	10.3	10.6	10.9
T86	9.8	10.1	10.4	10.7	11.0
T87	9.9	10.2	10.5	10.8	11.1
T88	10.0	10.3	10.6	10.9	11.2
T89	10.1	10.4	10.7	11.0	11.3
T90	10.2	10.5	10.8	11.1	11.4
T91	10.3	10.6	10.9	11.2	11.5
T92	10.4	10.7	11.0	11.3	11.6
T93	10.5	10.8	11.1	11.4	11.7
T94	10.6	10.9	11.2	11.5	11.8
T95	10.7	11.0	11.3	11.6	11.9
T96	10.8	11.1	11.4	11.7	12.0
T97	10.9	11.2	11.5	11.8	12.1
T98	11.0	11.3	11.6	11.9	12.2
T99	11.1	11.4	11.7	12.0	12.3
T100	11.2	11.5	11.8	12.1	12.4

B E A R I N G E

Table No. 6 Date July 21st, 1915.
 Bearing Load, LBS. 750 Time, beginning of run 10 A.M.
 Room Temp.° Fahr. 73 Time, end of run _____
 Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.315	670	9.92		0.106	0.0109	0.00833
0.295	621	9.28		0.092	0.0102	0.00778
0.275	538	8.67		0.094	0.0095	0.00725
0.27	495	8.50		0.067	0.0093	0.00710
0.26	385	8.18		0.050	0.0090	0.00687
0.265	365	8.34		0.048	0.0091	0.00695
0.27	304	8.50		0.041	0.0093	0.00710
0.275	288	8.66		0.040	0.0095	0.00625
0.28	212	8.82		0.030	0.0097	0.00741

Remarks:—

TABLE I

Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction between the acid and the base.

Concentration of the solution		Rate of the reaction		Time taken for the reaction to complete	
Acid	Base	Rate	Time	Rate	Time
0.1M	0.1M	0.1	100	0.1	100
0.2M	0.2M	0.2	50	0.2	50
0.3M	0.3M	0.3	33	0.3	33
0.4M	0.4M	0.4	25	0.4	25
0.5M	0.5M	0.5	20	0.5	20
0.6M	0.6M	0.6	16	0.6	16
0.7M	0.7M	0.7	14	0.7	14
0.8M	0.8M	0.8	12	0.8	12
0.9M	0.9M	0.9	11	0.9	11
1.0M	1.0M	1.0	10	1.0	10

B E A R I N G E

Table No. 7 Date July 21st, 1915.

Bearing Load, LBS. 600 Time, beginning of run _____

Room Temp.° Fahr. 73 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.265	645	8.34		0.086	0.0114	0.0087
0.26	596	8.18		0.078	0.0112	0.0086
0.24	525	7.57		0.063	0.0103	0.00786
0.23	441	7.25		0.051	0.0099	0.00756
0.22	388	6.94		0.043	0.0095	0.00725
0.21	292	6.63		0.031	0.0091	0.00695
0.215	266	6.78		0.029	0.0093	0.00710
0.23	177	7.25		0.020	0.0099	0.00756

Remarks:—

TABLE I

Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction between the acid and the base.

Concentration of the acid (M)	Concentration of the base (M)	Time taken for the reaction to complete (sec)	Rate of the reaction (M/sec)	Temperature (°C)
0.1	0.1	100	0.001	25
0.2	0.2	50	0.002	25
0.3	0.3	33	0.003	25
0.4	0.4	25	0.004	25
0.5	0.5	20	0.005	25
0.6	0.6	16.7	0.006	25
0.7	0.7	14.3	0.007	25
0.8	0.8	12.5	0.008	25
0.9	0.9	11.1	0.009	25
1.0	1.0	10	0.01	25

B E A R I N G E

Table No. 8 Date July 21st, 1915.

Bearing Load, LBS. 450 Time, beginning of run _____

Room Temp.° Fahr. 73 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.215	659	6.78		0.071	0.0124	0.00946
0.205	558	6.48		0.057	0.0118	0.00901
0.195	476	6.15		0.046	0.0113	0.00862
0.19	445	5.99		0.042	0.0109	0.00832
0.18	365	5.68		0.033	0.0104	0.00794
0.17	320	5.36		0.027	0.0098	0.00748
0.16	260	5.04		0.021	0.0092	0.00703
0.17	189	5.36		0.016	0.0098	0.00748
0.175	149	5.52		0.013	0.0101	0.00771

Remarks:—

B E A R I N G E

Table No. 9 Date July 21st, 1915.

Bearing Load, LBS. 300 Time, beginning of run _____

Room Temp.° Fahr. 73 Time, end of run _____

Observers _____

NOTE:—All data average of four bearings.

POUNDS at 31½ in. radius	R. P. M.	TORQUE		Horse Power to Drive	COEFFICIENT OF FRICTION	
		Inch	Lbs.		Shaft	Bearing
0.20	671	6.31		0.067	0.0173	0.01320
0.19	632	5.98		0.060	0.0164	0.01251
0.18	591	5.68		0.053	0.0155	0.01182
0.165	529	5.20		0.044	0.0142	0.01083
0.155	411	4.88		0.032	0.0134	0.01023
0.145	377	4.57		0.027	0.0125	0.00953
0.14	318	4.42		0.022	0.0121	0.00923
0.13	247	4.10		0.016	0.0112	0.00855
0.13	202	4.10		0.013	0.0112	0.00855
0.14	128	4.26		0.009	0.0117	0.00893
0.145	66	4.41		0.005	0.0121	0.00923

Remarks:—

TABLE 1

Summary of the results of the analysis of variance for the effect of the concentration of the solution on the rate of the reaction. The data are given in the form of the mean values of the rate constants k and the standard deviations σ for the different concentrations of the solution.

Temperature
25°C.

Concentration of the solution, M	Mean value of k , sec. ⁻¹	Standard deviation σ , sec. ⁻¹	Mean value of k , sec. ⁻¹	Standard deviation σ , sec. ⁻¹	Mean value of k , sec. ⁻¹	Standard deviation σ , sec. ⁻¹
0.001	0.001	0.001	0.001	0.001	0.001	0.001
0.002	0.002	0.002	0.002	0.002	0.002	0.002
0.005	0.005	0.005	0.005	0.005	0.005	0.005
0.010	0.010	0.010	0.010	0.010	0.010	0.010
0.020	0.020	0.020	0.020	0.020	0.020	0.020
0.050	0.050	0.050	0.050	0.050	0.050	0.050
0.100	0.100	0.100	0.100	0.100	0.100	0.100
0.200	0.200	0.200	0.200	0.200	0.200	0.200
0.500	0.500	0.500	0.500	0.500	0.500	0.500
1.000	1.000	1.000	1.000	1.000	1.000	1.000
2.000	2.000	2.000	2.000	2.000	2.000	2.000
5.000	5.000	5.000	5.000	5.000	5.000	5.000
10.000	10.000	10.000	10.000	10.000	10.000	10.000
20.000	20.000	20.000	20.000	20.000	20.000	20.000
50.000	50.000	50.000	50.000	50.000	50.000	50.000
100.000	100.000	100.000	100.000	100.000	100.000	100.000
200.000	200.000	200.000	200.000	200.000	200.000	200.000
500.000	500.000	500.000	500.000	500.000	500.000	500.000
1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000

DATA INTERPOLATED
FROM TABLES 1—9

Bearing E

R. P. M. of Shaft 600

Table No. 10

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500		0.016	0.014
1350	0.245	0.016	0.014
1200	0.2	0.014	0.0105
1050	0.14	0.0125	0.0096
900	0.10	0.0095	0.0075
750	0.09	0.0101	0.008
600	0.077	0.0103	0.0082
450	0.057	0.0157	0.012
300	0.063	0.0137	0.0092

Remarks:—

1870	1871	1872	1873
1874	1875	1876	1877
1878	1879	1880	1881
1882	1883	1884	1885
1886	1887	1888	1889
1890	1891	1892	1893
1894	1895	1896	1897
1898	1899	1900	1901
1902	1903	1904	1905
1906	1907	1908	1909
1910	1911	1912	1913
1914	1915	1916	1917
1918	1919	1920	1921
1922	1923	1924	1925
1926	1927	1928	1929
1930	1931	1932	1933
1934	1935	1936	1937
1938	1939	1940	1941
1942	1943	1944	1945
1946	1947	1948	1949
1950	1951	1952	1953
1954	1955	1956	1957
1958	1959	1960	1961
1962	1963	1964	1965
1966	1967	1968	1969
1970	1971	1972	1973
1974	1975	1976	1977
1978	1979	1980	1981
1982	1983	1984	1985
1986	1987	1988	1989
1990	1991	1992	1993
1994	1995	1996	1997
1998	1999	2000	2001
2002	2003	2004	2005
2006	2007	2008	2009
2010	2011	2012	2013
2014	2015	2016	2017
2018	2019	2020	2021
2022	2023	2024	2025

DATA INTERPOLATED
FROM TABLES 1—9

Bearing _____ E _____

R. P. M. of Shaft 400 _____

Table No. 11 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.12	0.0107	0.008
1350	0.105	0.0098	0.0075
1200	0.088	0.0095	0.0072
1050	0.075	0.0092	0.0070
900	0.058	0.0088	0.0068
750	0.052	0.0095	0.0072
600	0.05	0.0095	0.0077
450	0.03	0.0127	0.0096
300	0.04	0.0105	0.008

Remarks:—

DATA INTERPOLATED
FROM TABLES 1-9

Bearing _____ E _____

R. P. M. of Shaft 200 _____

Table No. 12 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.06	0.01	0.0079
1350	0.05	0.009	0.007
1200	0.045	0.0095	0.0075
1050	0.04	0.0097	0.0075
900	0.033	0.0095	0.0075
750	0.03	0.0098	0.0075
600	0.025	0.0097	0.008
450	0.01	0.0115	0.0088
300	0.016	0.0098	0.0074

Remarks:—

DATA INTERPOLATED
FROM TABLES 1-9

Bearing _____ E _____

R. P. M. of Shaft _____ 100 _____

Table No. 13 _____

Bearing Load	Horse Power to Drive	COEFFICIENT OF FRICTION	
		Shaft	Bearing
1500	0.046	0.0105	0.0085
1350	0.036	0.0095	0.0076
1200	0.035	0.0106	0.0089
1050	0.023	0.011	0.0085
900	0.026	0.011	0.0089
750	0.025	0.0105	0.0082
600	0.01	0.0102	0.0085
450	0.005	0.012	0.009
300	0.007	0.0097	0.0073

Remarks:—

TABLE I			
Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction			
Concentration of the solution (M)	Rate of the reaction (M/min)	Rate of the reaction (M/min)	Rate of the reaction (M/min)
0.01	0.001	0.001	0.001
0.02	0.002	0.002	0.002
0.03	0.003	0.003	0.003
0.04	0.004	0.004	0.004
0.05	0.005	0.005	0.005
0.06	0.006	0.006	0.006
0.07	0.007	0.007	0.007
0.08	0.008	0.008	0.008
0.09	0.009	0.009	0.009
0.10	0.010	0.010	0.010
0.11	0.011	0.011	0.011
0.12	0.012	0.012	0.012
0.13	0.013	0.013	0.013
0.14	0.014	0.014	0.014
0.15	0.015	0.015	0.015
0.16	0.016	0.016	0.016
0.17	0.017	0.017	0.017
0.18	0.018	0.018	0.018
0.19	0.019	0.019	0.019
0.20	0.020	0.020	0.020
0.21	0.021	0.021	0.021
0.22	0.022	0.022	0.022
0.23	0.023	0.023	0.023
0.24	0.024	0.024	0.024
0.25	0.025	0.025	0.025
0.26	0.026	0.026	0.026
0.27	0.027	0.027	0.027
0.28	0.028	0.028	0.028
0.29	0.029	0.029	0.029
0.30	0.030	0.030	0.030
0.31	0.031	0.031	0.031
0.32	0.032	0.032	0.032
0.33	0.033	0.033	0.033
0.34	0.034	0.034	0.034
0.35	0.035	0.035	0.035
0.36	0.036	0.036	0.036
0.37	0.037	0.037	0.037
0.38	0.038	0.038	0.038
0.39	0.039	0.039	0.039
0.40	0.040	0.040	0.040
0.41	0.041	0.041	0.041
0.42	0.042	0.042	0.042
0.43	0.043	0.043	0.043
0.44	0.044	0.044	0.044
0.45	0.045	0.045	0.045
0.46	0.046	0.046	0.046
0.47	0.047	0.047	0.047
0.48	0.048	0.048	0.048
0.49	0.049	0.049	0.049
0.50	0.050	0.050	0.050
0.51	0.051	0.051	0.051
0.52	0.052	0.052	0.052
0.53	0.053	0.053	0.053
0.54	0.054	0.054	0.054
0.55	0.055	0.055	0.055
0.56	0.056	0.056	0.056
0.57	0.057	0.057	0.057
0.58	0.058	0.058	0.058
0.59	0.059	0.059	0.059
0.60	0.060	0.060	0.060
0.61	0.061	0.061	0.061
0.62	0.062	0.062	0.062
0.63	0.063	0.063	0.063
0.64	0.064	0.064	0.064
0.65	0.065	0.065	0.065
0.66	0.066	0.066	0.066
0.67	0.067	0.067	0.067
0.68	0.068	0.068	0.068
0.69	0.069	0.069	0.069
0.70	0.070	0.070	0.070
0.71	0.071	0.071	0.071
0.72	0.072	0.072	0.072
0.73	0.073	0.073	0.073
0.74	0.074	0.074	0.074
0.75	0.075	0.075	0.075
0.76	0.076	0.076	0.076
0.77	0.077	0.077	0.077
0.78	0.078	0.078	0.078
0.79	0.079	0.079	0.079
0.80	0.080	0.080	0.080
0.81	0.081	0.081	0.081
0.82	0.082	0.082	0.082
0.83	0.083	0.083	0.083
0.84	0.084	0.084	0.084
0.85	0.085	0.085	0.085
0.86	0.086	0.086	0.086
0.87	0.087	0.087	0.087
0.88	0.088	0.088	0.088
0.89	0.089	0.089	0.089
0.90	0.090	0.090	0.090
0.91	0.091	0.091	0.091
0.92	0.092	0.092	0.092
0.93	0.093	0.093	0.093
0.94	0.094	0.094	0.094
0.95	0.095	0.095	0.095
0.96	0.096	0.096	0.096
0.97	0.097	0.097	0.097
0.98	0.098	0.098	0.098
0.99	0.099	0.099	0.099
1.00	0.100	0.100	0.100

CURVES PLOTTED FROM
TABLES 1 - 13
OF
BEARING "E"

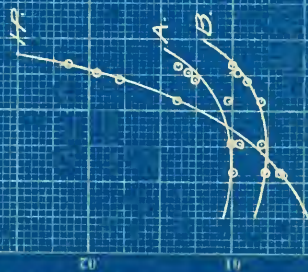
DEPARTMENT OF THE ARMY
 OFFICE OF THE CHIEF OF ENGINEERS
 WASHINGTON, D. C.

BEARING E TABLE NO. 1.
 BEARING LOAD 1500 LBS.
 ROOM TEMP. 73°

COEFFICIENT OF FRICTION

HORSE POWER TO DRIVE

R. P. M. OF SHAFT

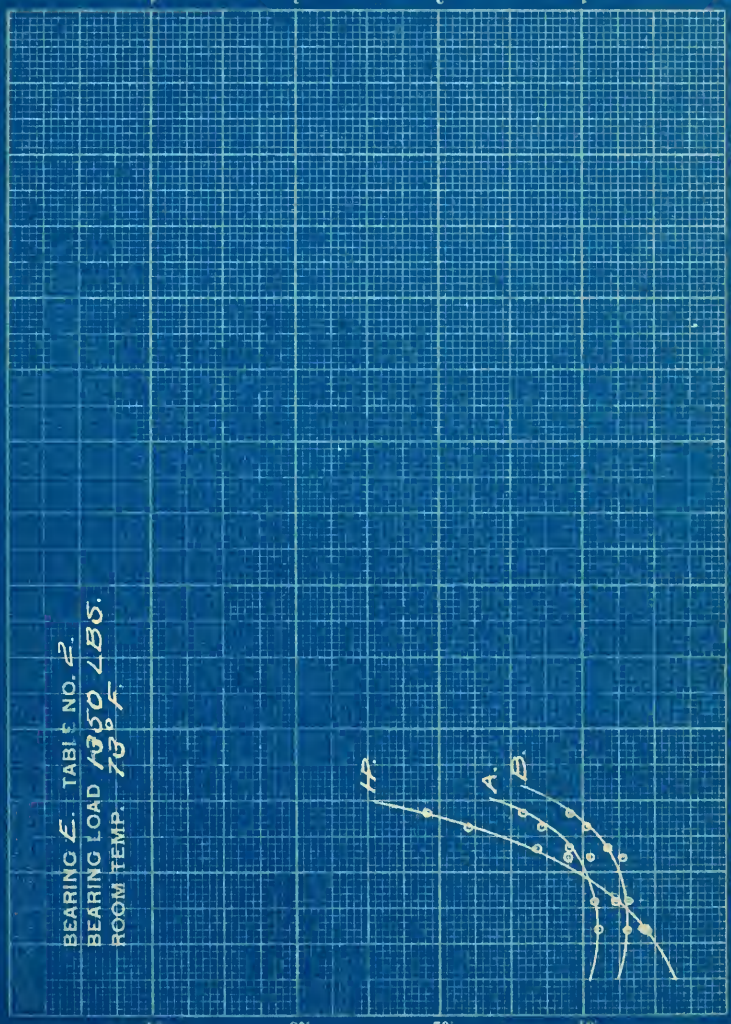


BEARING E. TABLE NO. 2.
 BEARING LOAD 1350 LBS.
 ROOM TEMP. 73° F.

HORSE POWER TO DRIVE

COEFFICIENT OF FRICTION

R. P. M. OF SHAFT



HORSE POWER TO DRIVE

.4
.3
.2
.1

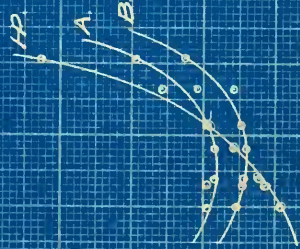
R. P. M. OF SHAFT

TABLE NO. 3
BEARING LOAD 1800 LBS.
ROOM TEMP. 73°F

COEFFICIENT OF FRICTION

.01
.02
.03
.04

400 800 1200 1600 2000 2400



BEARING E TABLE NO. 4
 BEARING LOAD 1050 LBS.
 ROOM TEMP. 73° F.

HORSE POWER TO DRIVE

4

3

2

1

2400

2000

1600

1200

800

400

R. P. M. OF SHAFT

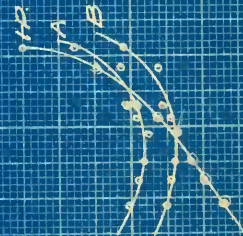
COEFFICIENT OF FRICTION

0.4

0.3

0.2

0.1



HORSE POWER TO DRIVE

4

.3

.2

.1

2400

2000

1600

1200

800

400

R. P. M. OF SHAFT

BEARING *F* TABLE NO. 5
 BEARING LOAD 900 LBS.
 ROOM TEMP. 73° F

COEFFICIENT OF FRICTION

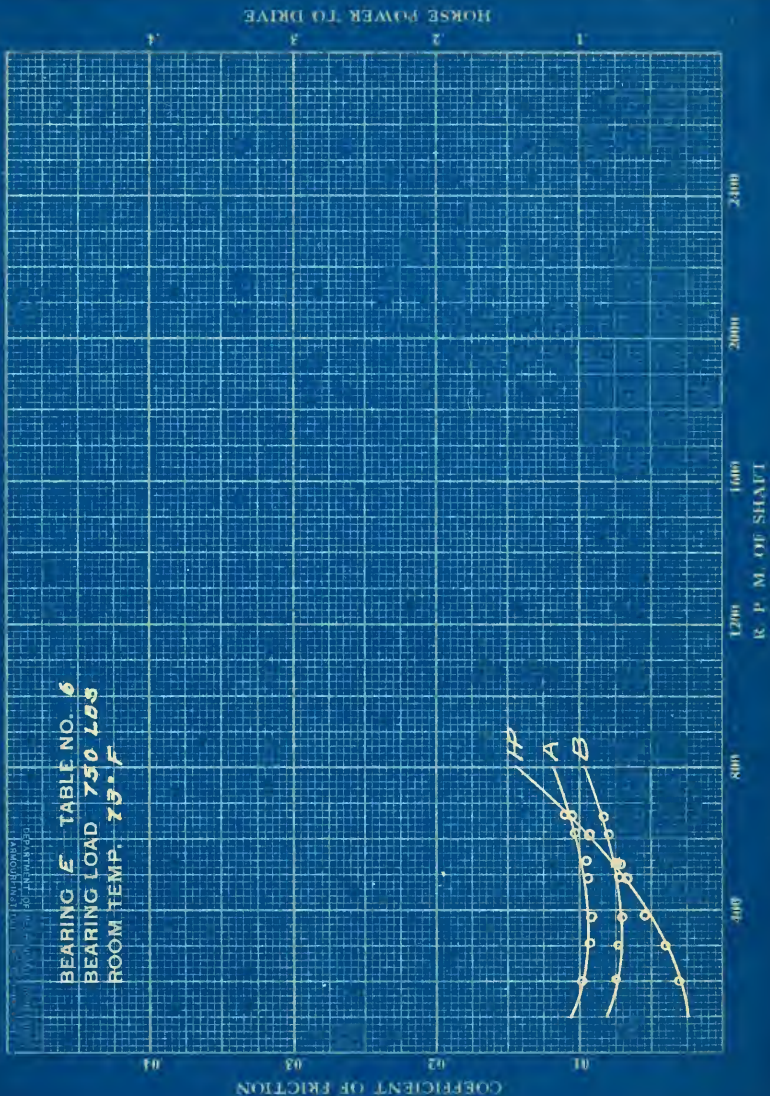
.04

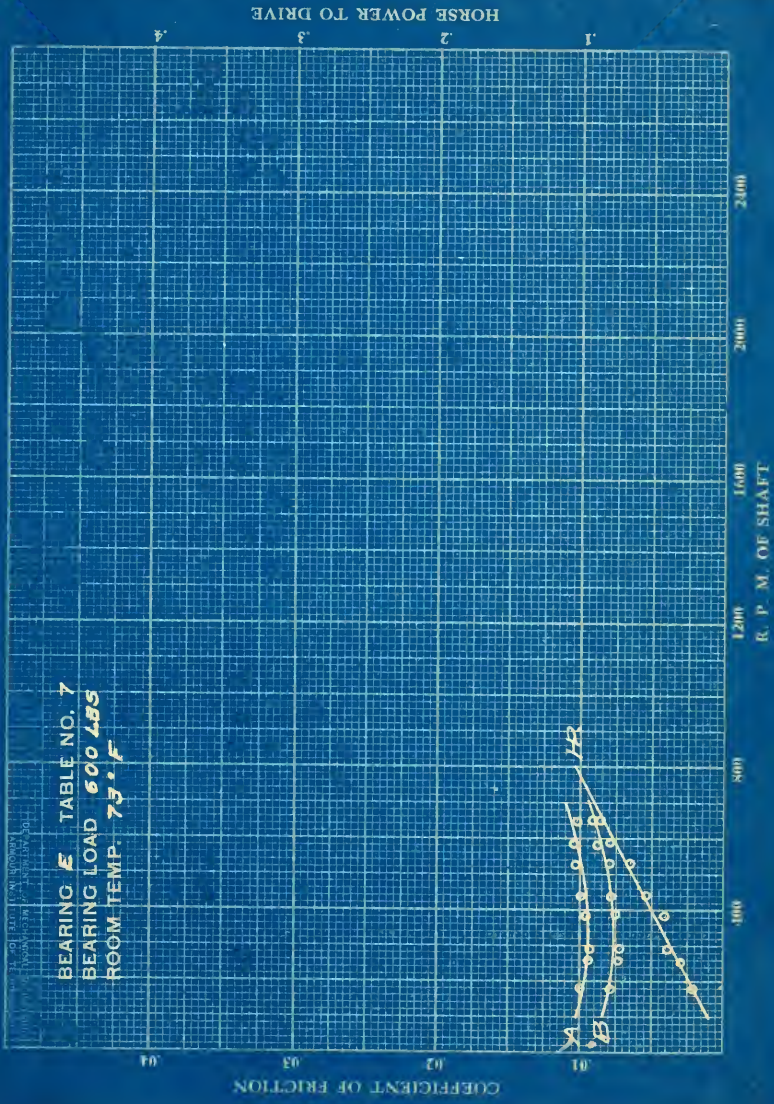
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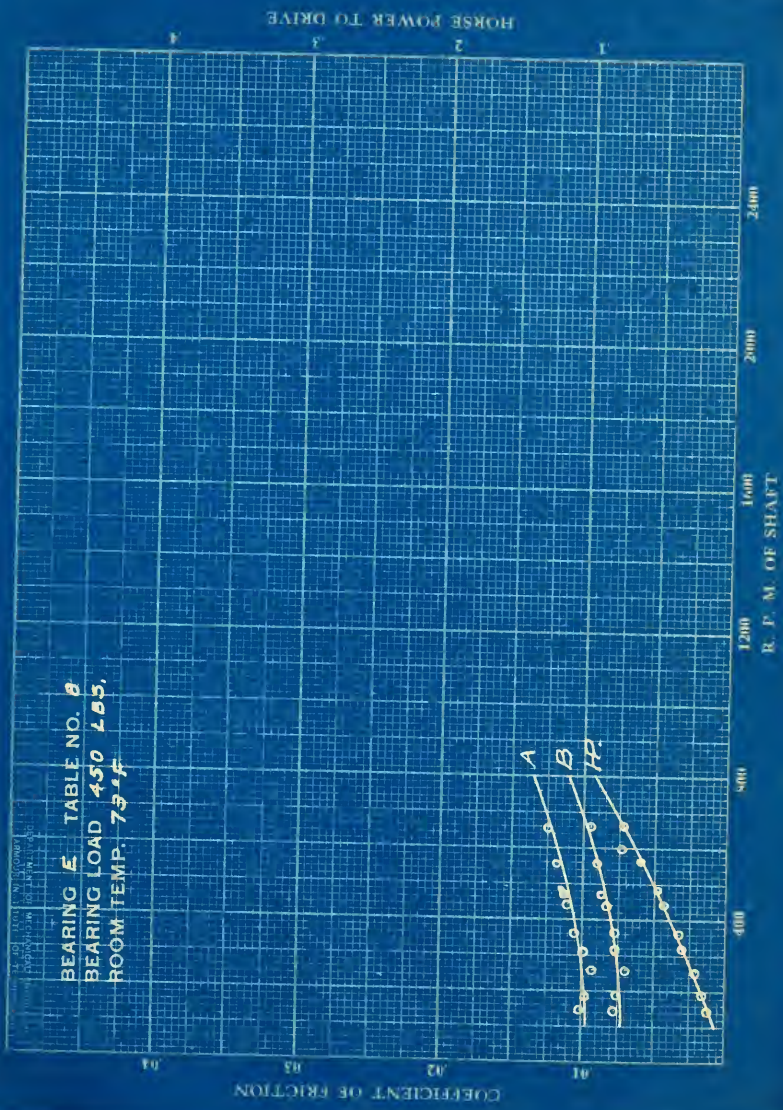
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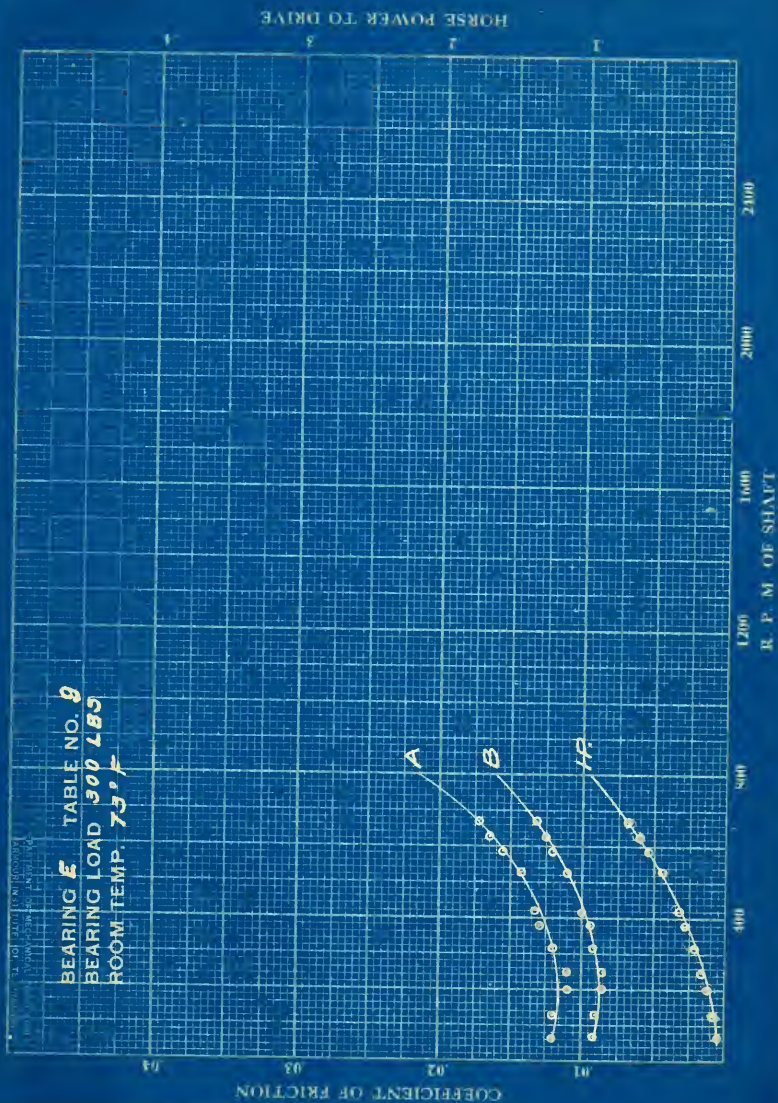
.01



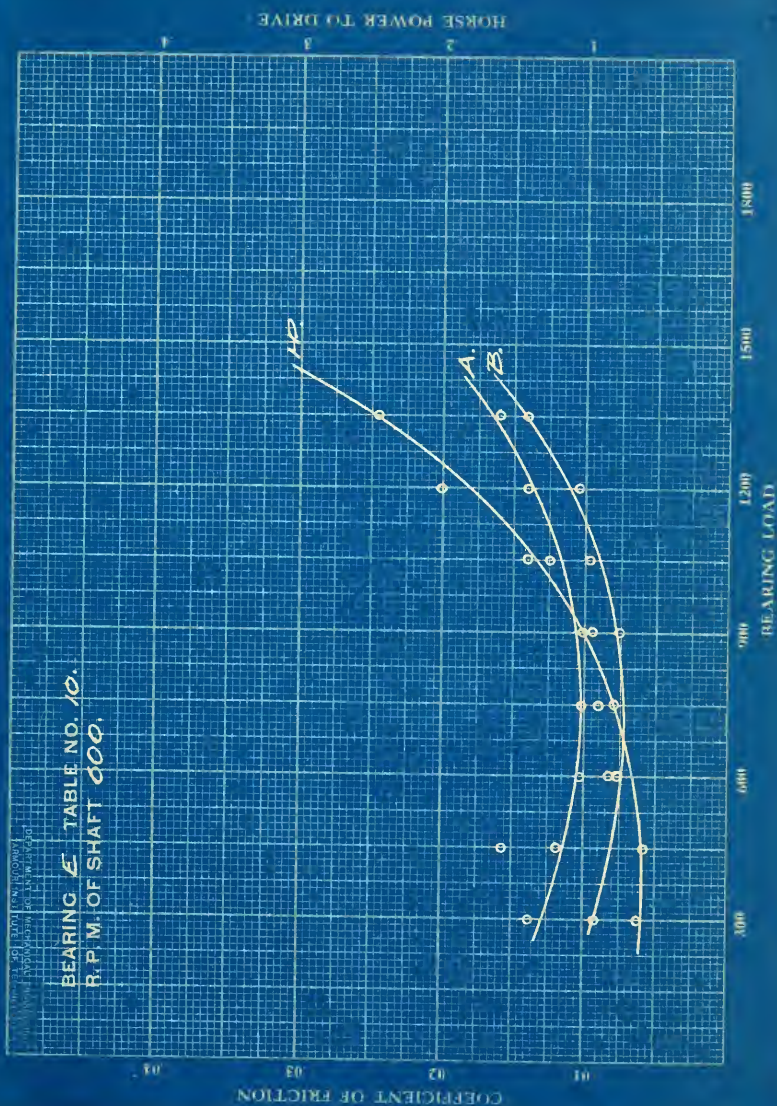


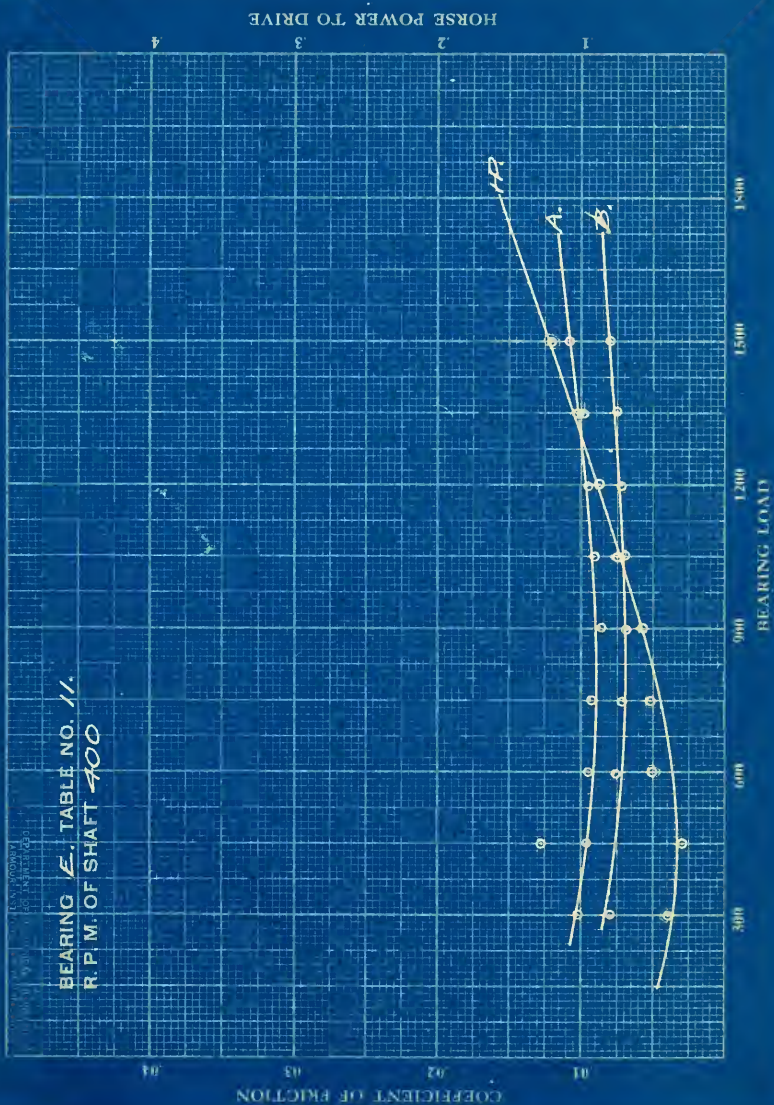




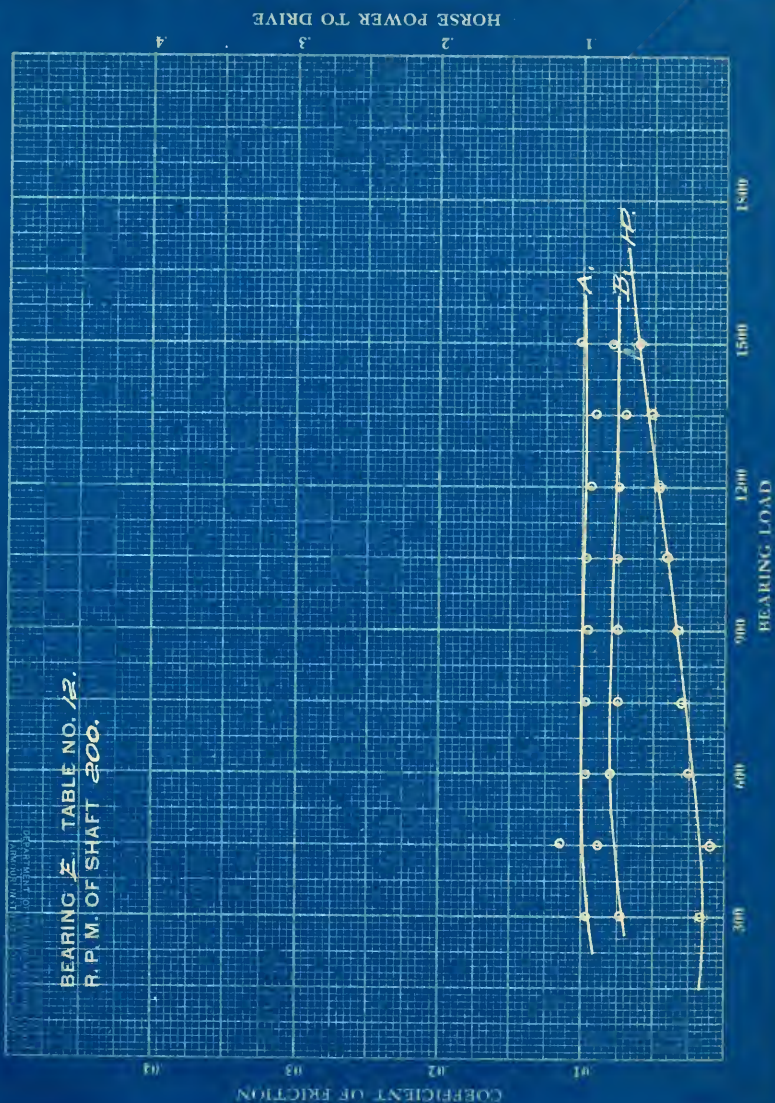


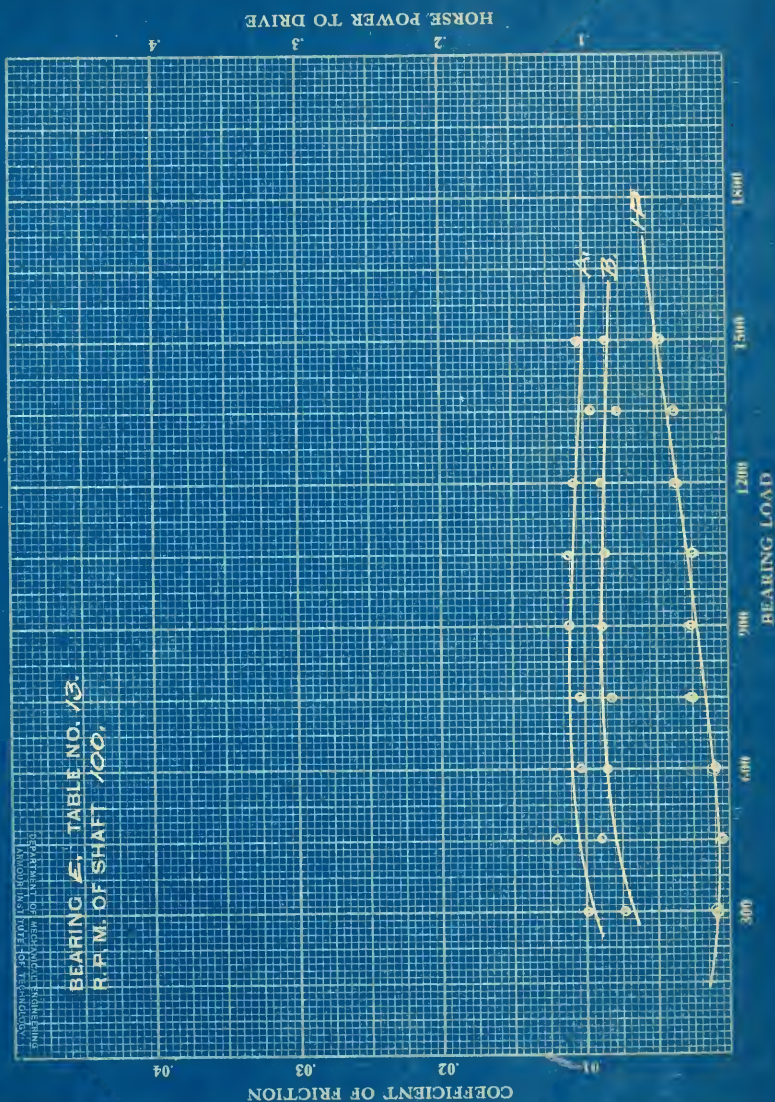
BEARING E TABLE NO. 10.
R.P.M. OF SHAFT 600.



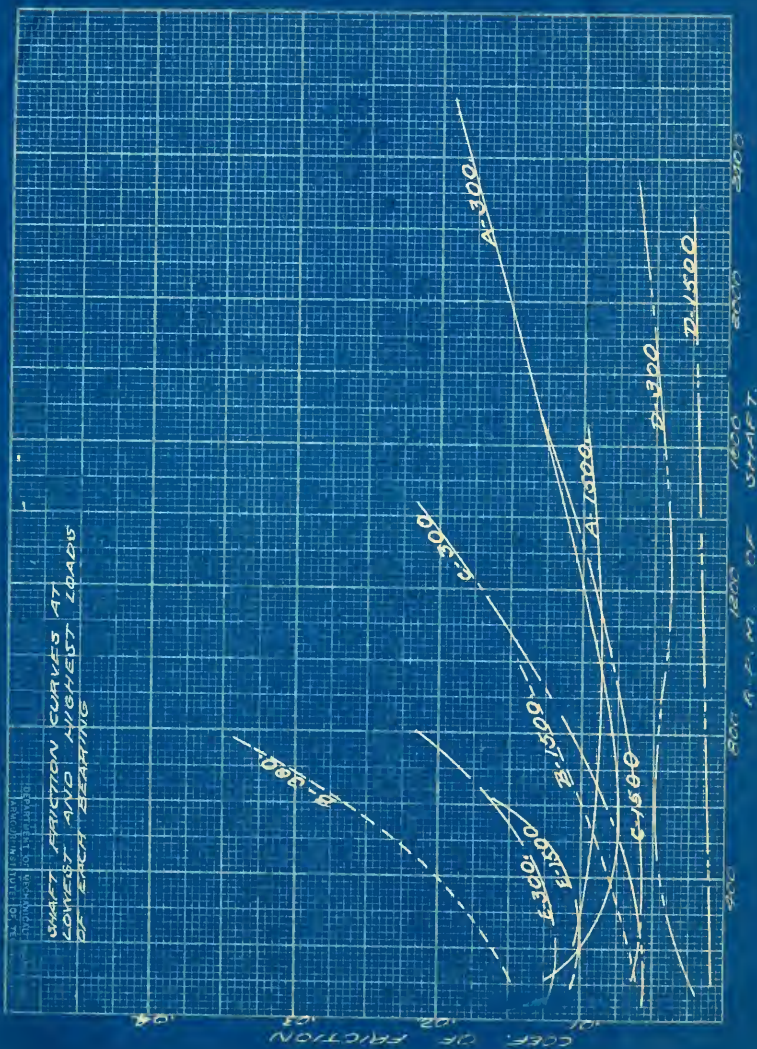


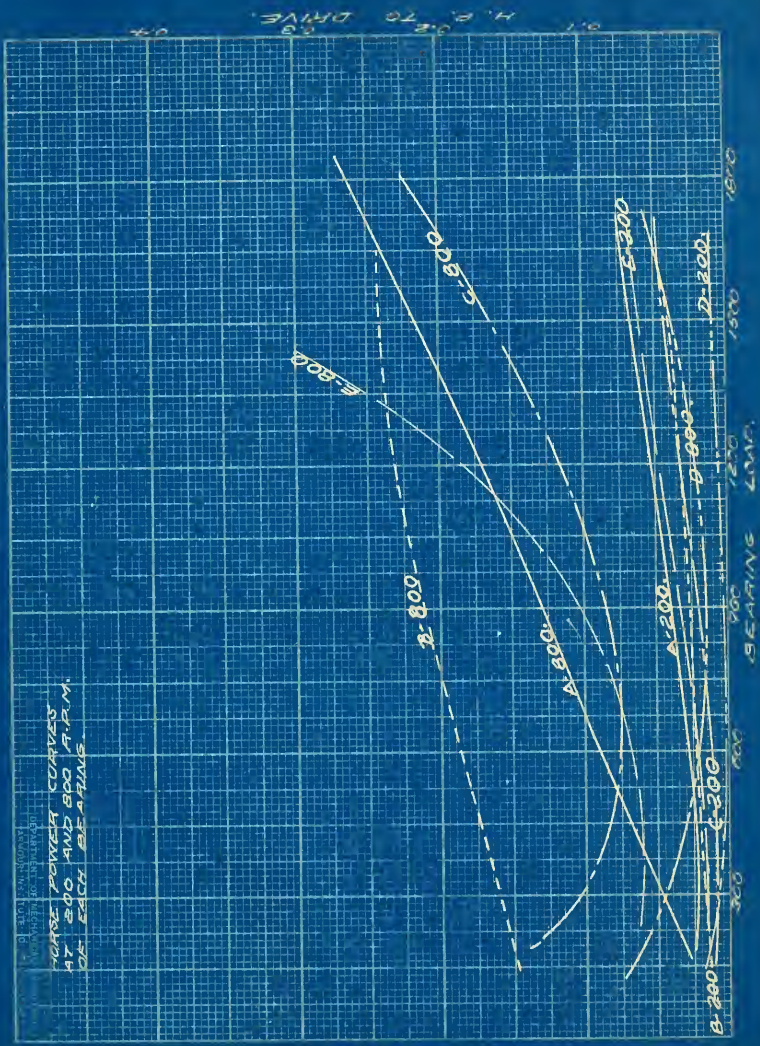
BEARING F. TABLE NO. 12.
R. P. M. OF SHAFT 200.

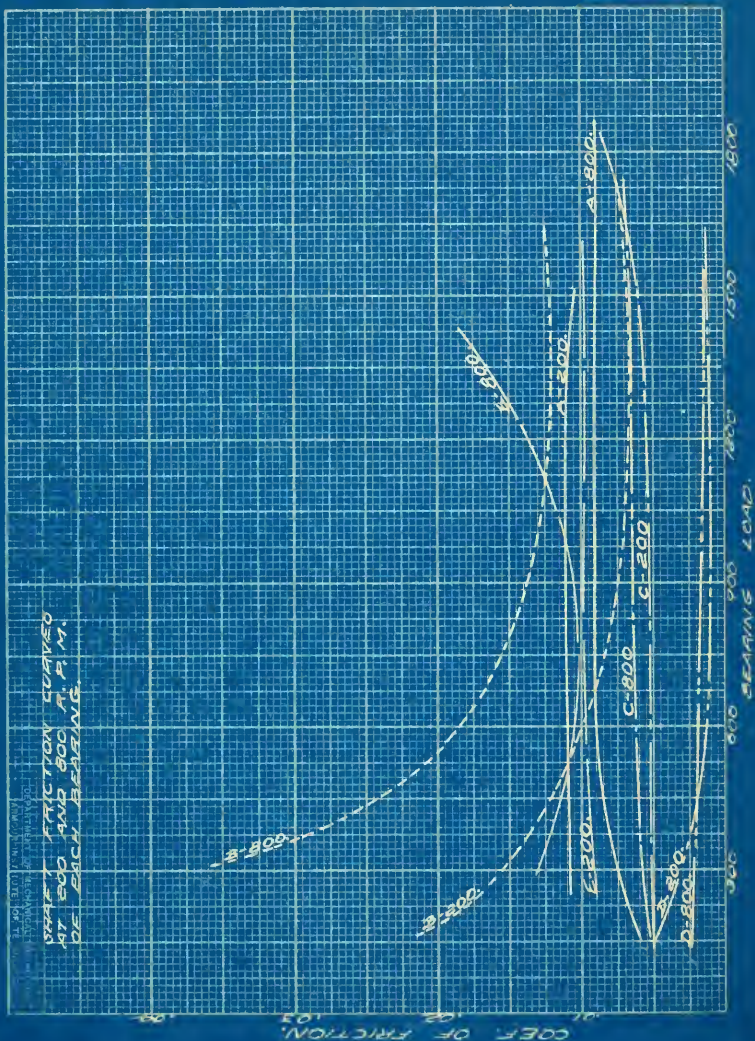




MAXIMUM AND MINIMUM
CURVES FOR
ALL BEARINGS







DISCUSSION OF RESULTS

DISCUSSION OF RESULTS

The first set of curves, plotted from tables 1 to 9, are those whose values are taken directly from the results of the test. Each sheet shows the curves for coefficients of friction and horse power to drive as compared to the speed of the shaft at some particular load.

The second set of curves, tables 10 to 16, were interpolated from the first set. The speed on each sheet being constant and the points plotted against a varying bearing load.

The third set is a résumé of the first set showing the maximum and minimum curves of the first set for each bearing.

The fourth set is a résumé of the second set, showing maximum and minimum curves for each bearing.

In all cases each curve is plainly marked with the bearing initial.

It will be seen from the sheet showing the maximum and minimum curves for each

Bearing plotted against the speed of the shaft that in every case, the coefficient of friction decreases as the load increases and that the coefficient of friction increases as the speed increases.

This sheet shows that Bearing "D", the ball bearing has the lower coefficient of friction at any load and speed than any other bearing. It further shows that the coefficient does not vary much with differences in load, and that it varies very little with any increase in speed, thus, giving to it all the desirable features of a shating bearing.

Bearing "C", the babbitt bearing showed itself to be next best at the low speeds, but, as soon as the speeds increased beyond five or six hundred R.P.M., Bearing "A", the duplex roller bearing showed itself to be better. Bearing "A" was very nearly as good as the babbitt at low speeds and very much better at high speeds, it being the only bearing which we could run at much more than 2000 R.P.M. It showed itself to be similar to the ball bearing because its curve was flat at all

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loads and speeds. So for this reason, we should say that it was the second best bearing we tested.

At the low loads and low speeds, Bearing "B", the spiral roller bearing, showed itself to be the poorest of all, and at high speeds it had a tendency to increase its coefficient of friction to infinity.

Bearing "E", the third roller bearing was fairly good at low speeds, but, poor at high speeds. It did not vary to any great extent for the difference in load, but, as a whole the coefficient of friction was far too high.

Bearing "D" also showed its superiority by virtue of the fact that it took less power to drive it at any speed and load than any other bearing.

Bearings "A", "B", "C" and "E" showed themselves to take about the same power to drive at low speeds, although, Bearing "A" may be given the preference since it requires less power at the low speeds than the others.

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At the high speeds and high loads, Bearing "A" also showed up well, although, very little better than the babbitt.

Bearing "B" and "E" showed up well on the low speeds only, but, an increased speed caused their friction to increase rapidly.

All the curves showed that the horse power necessary to drive increased with the load and increased with the speed.

Arthur Katzinger
Arthur S. Kater

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